AGRICULTURAL ENGINEERING

NOVEMBER • 1948

Processing of Sugar Beet Seed for Precision Planting — *Roy Bainer*

Sugar Beet Harvesters for Mechanized Harvesting — *J. L. Hipple and E. F. Blackwelder*

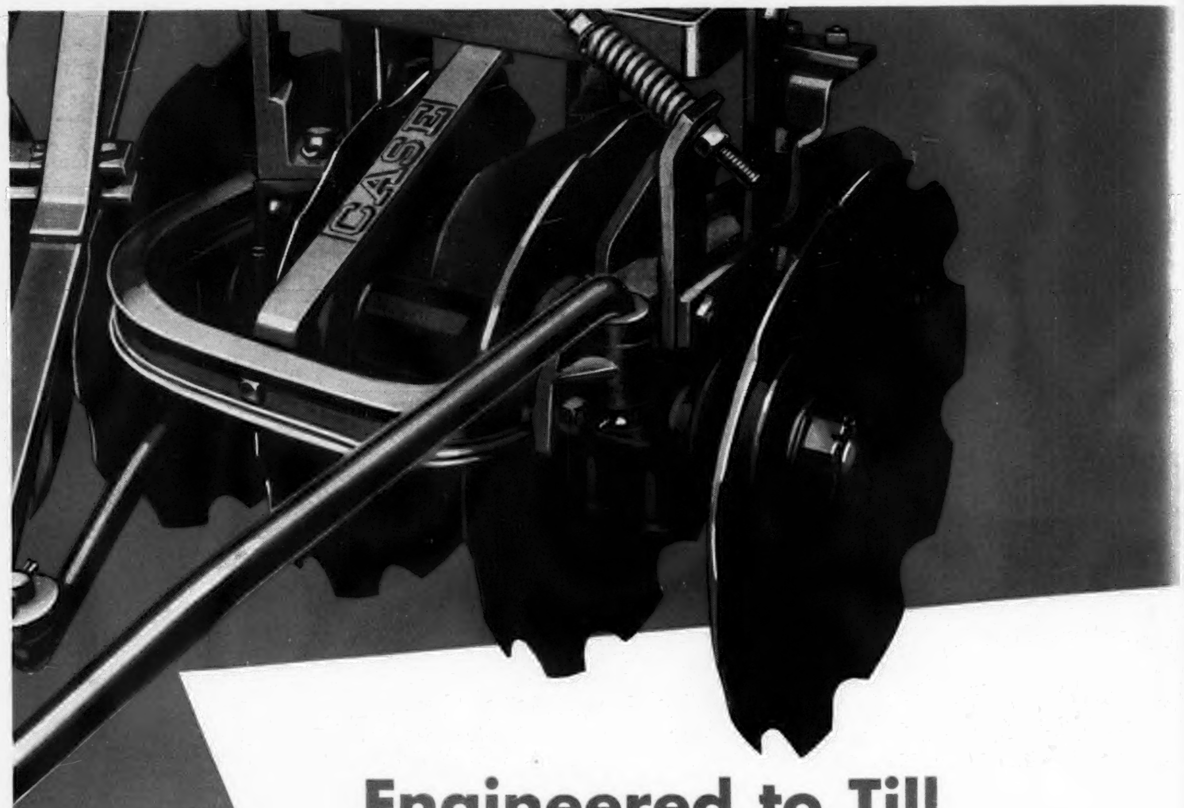
Characteristics of Concrete Draintile for Alkali Soils — *P. W. Manson and D. G. Miller*

Structures Designed for Self-Feeding of Hay and Ensilage — *Chas. H. Reed*

The Use of Snow Survey Data for Agricultural Planning — *W. T. Frost and R. A. Work*

ASAE Winter Meeting • Chicago—December 13-15, 1948

THE JOURNAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS


CASE

AGRICULTURAL ENGINEERING

Established 1920

CONTENTS FOR NOVEMBER, 1948

Vol. 29, No. 11

EDITORIAL 475

THE PROCESSING OF SUGAR BEET SEED 477
By Roy Bainer

THE INTERNATIONAL SUGAR BEET HARVESTER 480
By J. L. Hipple

DEVELOPMENT OF THE MARBEET SUGAR BEET HARVESTER 481
By E. F. Blackwelder

THE 1947 MECHANICAL HARVESTING OF SUGAR BEETS 482
By Austin A. Armer, Rowland W. Cannon, and P. A. Reeve

ESSENTIAL CHARACTERISTICS OF DURABLE CONCRETE DRAINTILE FOR ALKALI SOILS 485
By Philip W. Manson and Dalton G. Miller

FARM STRUCTURES DESIGNED FOR THE SELF-FEEDING OF HAY AND ENSILAGE 488
By Charles H. Reed

THE USE OF SNOW SURVEY DATA FOR AGRICULTURAL PLANNING 490
By W. T. Frost and R. A. Work

AGRICULTURAL ENGINEERING IN THE NORTHEAST 493
By Harry E. Besley

"WHAT IS PROFESSIONAL RECOGNITION" 495

RESEARCH NOTES 496

NEWS SECTION 500

PERSONNEL SERVICE BULLETIN 514

AGRICULTURAL ENGINEERING is indexed regularly by Engineering Index, Inc.

INDEX TO ADVERTISERS

Aeroquip Corp. 505
American Zinc Inst. 510
Baldwin-Duckworth Div. of Chain Belt Co. 497
Bendix Aviation Corp., Pacific Div. 504
J. I. Case Co. ..... 2nd cover
Caterpillar Tractor Co. 474
Dearborn Motors Corp. 470
John Deere 469
Donaldson Co. 508
Douglas Fir Plywood Assn. 501
Fairbanks, Morse & Co. 512
Firestone Tire & Rubber Co. 468
Ford Motor Co. 467
Fox River Tractor Co. 472
French & Hecht, Inc. 516
Ingersoll Steel Div., Borg-Warner Corp. 476
James Mfg. Co. 499
Link-Belt Co. 465
Massey-Harris Co. 503
Mechanics Universal Joint Div., Borg-Warner Corp. 511
New Departure, Div. of General Motors Corp. ..... 3rd cover
Portland Cement Assn. 506
Rilco Laminated Products, Inc. 507
J. B. Sedberry, Inc. 514
The Sisalkraft Co. 502
Great Lakes Steel Corp., Stran-Steel Div. 509
Timken Roller Bearing Co. ..... 4th cover
United Specialties Co., United Air Cleaner Div. 473
U. S. Rubber Co. 471
Westinghouse Electric Corp. 515
Wisconsin Motor Corp. 514

AGRICULTURAL ENGINEERING is owned, edited, and published monthly by the American Society of Agricultural Engineers. The editorial, subscription and advertising departments are at the executive office of the Society, Saint Joseph, Michigan.

SUBSCRIPTION PRICE: $3.00 a year, plus an extra postage charge to all countries to which the second-class postage rate does not apply; to A.S.A.E. members anywhere, $2.00 a year. Single copies (current), 30 cents each.

POST OFFICE ENTRY: Entered as second-class matter, October 28, 1933, at the post office at Benton Harbor, Michigan, under the Act of August 24, 1912. Additional entry at St. Joseph, Michigan. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 11, 1921.

AGRICULTURAL ENGINEERING is a member of the Audit Bureau of Circulations.

ADVERTISING REPRESENTATIVES

Chicago, 2: DWIGHT H. EARLY
100 North LaSalle St.
Telephone: CEntral 6-2184

New York, 17: A. M. WILLCOX
420 Lexington Ave.
Tele.: LEXington 2-4735

RAYMOND OLNEY
Editor and Business Manager

EDITORIAL

Agricultural Mobilization

INDUSTRIAL mobilization is of renewed current interest as a common-sense matter of preparedness, in the face of communism's threat to take advantage of any weakness it can find in democracy.

Agricultural engineers are in a position to make a vital contribution to that preparedness. Mobilization means some uncomfortable but necessary compromises. Those with which agricultural engineers are particularly concerned are the diversion of labor, management, supplies, and supply production capacity from agriculture; the simultaneous demand for increased production by agriculture; and the problems of conserving agriculture's future production capacity while meeting the urgent immediate pressures for production.

The mobilization load, superimposed on normal peacetime requirements, creates an intensive competition for men, materials, and machines from the national pool. The men responsible for allocations to achieve a balanced mobilization cannot be all-wise. In the numerous, hard-boiled compromise decisions which they must make under considerable pressure, they can only be guided by the best information made available to them. Expensive mistakes can result from failure of any particular activity to present a strong and reasonable case on a genuine need for the wherewithal to handle its mobilization job effectively.

Necessary information on the output volume requirements of agricultural mobilization can be computed and supplied by men familiar with quantity consumption and market volume statistics. Information on the means by which agriculture can produce the desired volume can only be provided by men much closer to the problems of actual farm operation. The fact that our farm production normally totals up to astronomical figures does not mean that adequate volume can be taken for granted.

It occurs to us that a reasonable case for the agricultural production requirements of mobilization must recognize two distinct types of farms. These are the comparatively small percentage of commercial farms which supply the largest percentage of farm produce reaching national market channels, and the larger number of so-called farms which actually contribute little to trade volume.

Commercial farms are not as flexible as might sometimes be imagined, in the means by which they achieve efficient quantity production. Adjustment of total acreage farmed as one unit is generally difficult, often impossible. Commercial farms need experienced personnel. School children, transients, and other part-time workers may help with certain peak-labor jobs, but they cannot replace experienced full-time men. In a production emergency the commercial farm may need even increased amounts of petroleum products, fertilizers, and other chemicals, for example, to produce at maximum efficiency.

Even with unusual care, it will need normal replacements of equipment and equipment parts. It will need parts from the individual manufacturers of its various equipment units, and those manufacturers need enough materials and production capacity allocated to their basic business rather than to other mobilization assignments, to meet this demand. Commercial farms cannot be expected to provide efficient, large-quantity production for mobilization needs, with makeshifts and leftovers.

The larger number of non-commercial farms contributing primarily to home consumption and strictly local markets are an entirely different problem, so far as mobilization is concerned. They can be raided for manpower, deprived of new equipment, put on reduced supply rations, and still continue to operate. With patches of land not readily fitted into commercial operations, salvaged spare time and family labor, odds and ends of available equipment, such farming supplies as may not be critical items, and local feeds and fertilizers which would otherwise be wasted, non-commercial farms can contribute materially to local self-sufficiency, morale, and the release of transportation and other critical facilities for mobilization assignments.

From the experience of World Wars I and II, it appears that commercial farming and its supporting industries rate an A-1 priority in mobilization to prevent or, if necessary, to prosecute another world war. Non-commercial farming, with the lowest priority on manpower and supplies, could still be encouraged as an important home-front salvage operation. We should be ready to make this distinction clear whenever and wherever agricultural mobilization may come up for consideration.

Conservation Research

CONSERVATION of natural resources is one of six major problems confronting the United States, according to a recent news report on results of an opinion survey among 73 faculty members at the Illinois Institute of Technology. In fact, they listed it as second only to peacetime use of atomic energy, and stressed the need of additional research in soil conservation as one approach to the problem.

Soil conservation research to date has shown that it can yield practical and profitable results. It has provided much of the current know-how in soil conservation practice. Technically it warrants continuation for the same reason as other scientific activities. It is one of many fields in which no limit has been seen to the amount of knowledge which research might produce.

From the standpoint of its significance, soil conservation research is a means of getting information on a larger problem which is gradually being forced upon our consciousness. That is the question of how much life our planet can support, on a sustained yield basis, in terms of total numbers of people and degrees of their well-being!

How much of the continuing wear and tear on our world and its capacity to support human life is due to physical forces of nature? How much is actually necessary to the support of the human population? And how much is sheer waste due to man's short-sighted pursuit of immediate objectives without thought of the future?

To what extent and in what manner can the waste of resources by both natural forces and human activities be reduced? To what extent and in what manner can the rebuilding forces of nature be aided and accelerated? What available resources can be put to better uses? Can a state of biological unbalance favorable to man be maintained indefinitely? If so, how, and to what extent?

It is evident that soil, as a physical and chemical foundation for plant life, will be a major consideration in the gradual evolution of knowledge on these points.

Soil conservation research is more than an academic interest. It is more than a short-range inquiry into handy methods of increasing farm productivity and income, although its cost could be more than justified on that basis. Soil conservation research is an activity of continuing important interest to the whole human race, bearing directly on its immediate wellbeing and its future destiny.

Engineering and Population Pressures

WHEN The American Association for the Advancement of Science celebrated its centenary in September, it showed notable intellectual concern and a sense of moral responsibility for growing problems of population pressures. In reporting this phase of the meeting, "Time" used appropriate exaggeration to emphasize the point succinctly, by heading its item "Standing Room Only."

Fairfield Osborn pointed out that "Within only three centuries, the population of the earth has increased five times. . . . . . It is now increasing at a net rate that, if continued, would double the earth's population again in another 70 years." *(Continued on page 506)*

AGRICULTURAL ENGINEERING

VOL. 29 NOVEMBER, 1948 NO. 11

The Processing of Sugar Beet Seed

By Roy Bainer

FELLOW A.S.A.E.

SUGAR beet seed processing investigation started at the California Agricultural Experiment Station in 1941 with the development of equipment for segmenting seed [1,2*]. Early studies indicated a potential saving of 10 man-hours per acre in the time required for thinning a crop planted with this new seed. The use of the seed was accelerated due to the war and its attendant labor shortage, with the result that within 3 or 4 years 80 to 90 per cent of the total beet acreage in the United States was planted with segmented seed.

The rapid adoption of segmented seed resulted in the demand for processed seed developing at a greater rate than the technique of the processing methods. Actually there was little basic information available for use in the early design of equipment capable of producing seed of optimum quality. This information, in many respects, is still not available, even though much experience has been gained from the processing of 30 to 40 million pounds of seed.

Field and laboratory experience revealed that certain characteristics of segmented seed behavior were related to the segmenting process. Among these principally were viability, singleness of germ, and recovery. In addition, some seed units produced abnormal seedlings as a result of receiving mechanical injury during the segmenting operation. Low viability in the segmented product was related to the quality of the original whole seed, the setting of the machine, and the inability of separating germ-containing units from non-germinating pieces without sacrificing too much good seed. The singleness of germ in the final product was related to the size, variety, and locality of production of the original seed, the extent of pregrading before processing, and the setting of the shear bar in the machine. Recovery of segmented seed was influenced by the relation of the germination of the segmented seed to the original sample and to the nearness of approach to a single-germ unit. It also varied somewhat with the size, variety, and moisture content of the whole seed. In fact, viability, singleness of germ, and recovery are closely related so that a change in one usually affects the others.

During the first year or two after the adoption of segmented seed, growers and processors alike were of the opinion that the goal in seed processing was the production of single-germ units. Several processors succeeded in producing and marketing a product that was made up of 85 to 90 per cent single-germ units. A final product having a germination of 85 to 90 per cent was made possible through the use of gravity table separators and aspirators. However, the production of single-germ seed of high germination resulted in low recoveries. Oftentimes, 100 lb of whole seed yielded only 30 lb of processed seed, of which 5 to 10 per cent produced abnormal seedlings.

Irregularities in field stands planted with segmented seed were attributed to poor planter placement with the result that requests were made for improved planting equipment. Intensive laboratory and field tests at the California station assisted in making improved planting equipment[3] available, equipment capable of metering and placing one seed at a time with reasonable accuracy.

As soon as experimental precision planting equipment became available, the plantings made at Davis included graded whole seed and large segmented seed. Each had a higher seedling count per viable unit than was commonly regarded as optimum for segmented seed. The plantings were made under a variety of field conditions, resulting in varying degrees of emergence. The data in Table 1 shows that the percentage of inches having single plants varies inversely with field emergence. For example, graded whole seed (12-10)† having a potential germination of 1.84 seedlings per viable seed ball gave 45.7 per cent singles at a field emergence‡ of 70.4 per cent, while at 30.1 per cent field emergence, the percentage of inches with single plants amounted to 72.7 per cent. Segmented seed (10-8), having a potential germination of 1.38 seedlings per viable seed ball, produced singles in 82.8 and 70.1 per cent of the beet containing inches at field emergences of 30.5 per cent and 53.9 per cent, respectively.

In the majority of areas where sugar beets are grown, the expected average field emergence of seedlings amounts to approximately 50 per cent of the potential value of the seed. It was quite evident in the test (Table 1) that seed capable of producing a higher percentage of seedlings (1.38) under laboratory

Fig. 1 *(Left)* A commercial sugar beet processing unit • Fig. 2 *(Right)* The seed processing unit in Fig. 1 opened up to show burr reduction unit (top) and decorticating unit (bottom)

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Oregon, June, 1948, as a contribution of the Power and Machinery Division.

ROY BAINER is head of the agricultural engineering division, University of California (and 1948 recipient of the Cyrus Hall McCormick Gold Medal.)

* Superscript numbers refer to appended references.

† (12-10) indicates size of seed. In this case, the seed passed through a 12/64-in round-hole screen and over a 10/64-in round-hole screen.

‡ Field emergence refers to the emergence of seedlings in the field as a percentage of the total seedlings per 100 seed units as shown by laboratory or greenhouse germination trials.

TABLE 1. COMPARISON BETWEEN FIELD EMERGENCE AND PERCENTAGE OF INCHES WITH SINGLES FOR GRADED WHOLE SEED AND LARGE SEGMENTED SEED

Seed	Size	Germination percentage	Seedlings per viable unit	Pounds per acre	Field emergence percentage	Per cent inches with singles
Whole	12-10	96.0	1.84	4.6	70.4	45.7
Whole	12-10	96.0	1.84	4.4	44.5	57.5
Whole	12-10	96.0	1.84	4.0	30.1	72.7
Segmented	10-8	92.6	1.38	3.4	53.9	70.1
Segmented	10-8	92.6	1.38	3.6	30.5	82.8

conditions than was once considered desirable, produced a stand of plants containing 70.1 per cent singles under a field emergence of 53.9 per cent. This compares with stands having 80 to 85 per cent singles when seed capable of producing 1.15 seedlings per viable seed unit was used in previous trials under similar field conditions. Actually the seedling stands were more uniform (less skips) when seed having a higher germ count was used. This indicates the desirability of having a greater safety factor in the seed, provided precision-planting equipment is used.

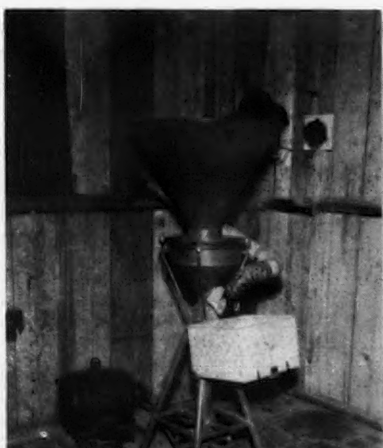
It was not long after the above trials were conducted that several of the seed processors were preparing and issuing seed that ran as high as 40 per cent doubles (1.4 seedlings per seed ball). In general, more uniform seedling stands resulted from the use of this seed. While the percentage of singles dropped somewhat, the advantage in labor saving did not decrease in the same ratio. Recoveries of seed in the processing plant were also improved.

Further research work relative to seed processing produced two new processes, namely, burr reduction and decortication[4]. Later the two processes were combined and put into commercial use. With the exception of the beets grown for one company, practically the entire 1948 sugar beet crop in California was planted for the first time with seed processed with this new equipment. In addition, part of the acreage in the intermountain area was similarly planted. The above-mentioned company used a commercial seed huller for decorticating after first running the seed through a segmenter with a wide setting of the shear bar. A new seed-processing unit was installed for the 1949 season.

The equipment, Figs. 1 and 2, used for preparing the seed consists of a 1½ x 10-in carborundum stone (Norton 37C24QV) and a 10-in burr plate (Letz AA230) for the first reduction stage. The second stage consists of a 1 x 20-in carborundum stone and a neoprene pressure pad of 20-in diameter. The stones are mounted on vertical shafts and driven at a peripheral speed of 2000 fpm through V belts from a common electric motor. Clearances between the stones and the burr and pressure pad are maintained at approximately 0.125 in. A slight taper (1/8 in per in) half way from the center to the outer edge of the pressure pad facilitates the feeding of seed. It was also found necessary to grind the corner, at the outer periphery of the pressure pad, at an angle of about 45 deg in order to prevent the formation of a lip as the pad became worn. In operation the pressure of the seed against the pad caused the surface to stretch slightly beyond the edges of the stone which in turn reduced the wear on this small section allowing the formation of an overhanging lip of neoprene which prevented accurate adjustment between the plate and the stone when the machine was idle. Both units are enclosed in steel cases with hoppered bottoms. The inner wall of the case surrounding the burr and pressure pad is lined with a ½-in layer of sponge rubber to reduce the shock to the seed as it hits the wall. The seed is fed to the center of the wheels from hoppers above. The rate of flow is regulated by an adjustable gate between the hopper and the burr reduction unit.

During operation, sack-run whole seed is fed directly from the hopper (Fig. 1) through the center of the burr plate to the center of the revolving stone. The seed is moved between the face of the stone and the burr plate by centrifugal force. This first stage operates as a prebreaker, reducing the size of the larger seed balls to the extent that the entire sample will pass through a 13/64-in screen. The output of the burr reduction unit feeds by gravity into the hopper above the decorticating unit. The partially reduced seed then passes between the neoprene pressure pad and the revolving stone, with the result that most of the corky material is rubbed off, and many of the locules are opened, thereby releasing many of the germs. The discharge from this unit consists mainly of one and two-germ seed pieces and a large volume of corky material removed from the seed. The seed is reduced to about 10/64-in size. The capacities of the 10-in burr reduction unit and the 20-in decorticating unit are comparable, namely, approximately 500 lb of whole seed per hour.

Following the decorticating operation, the seed is cleaned



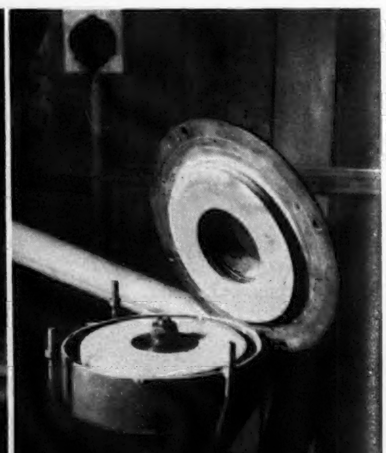


Fig. 3 *(Left)* An experimental sugar beet seed processing unit. A suction blower connected to the discharge of the machine removed the light corky material • Fig. 4 *(Center)* The unit shown in Fig. 3 opened to show burr plate. A stone having smaller granular structure has since been substituted for the rough stone • Fig. 5 *(Right)* Interior of decorticating unit showing the neoprene pressure pad

and graded. The light, corky material, as well as the lighter seed pieces, can be readily removed through the use of an aspirator designed by Austin A. Armer**. In the majority of cases, final grading has been done between 10/64 and 7/64-in round-hole screens. The exceptions have been to grade to 9-7 or 12-9 sizes. In the latter case, very little decortication was accomplished. Some processors use a gravity table separator for the final grading on the basis of density.

The results of preliminary runs with the machine are shown in Table 2. Five lots of seed of 1000 lb each were processed to a 9-7 size. Final grading was done on a gravity table. One hundred pounds of whole seed having a germination of 90.4 per cent and a seedling count of 1.9 produced 56 lb of processed seed with a germination of 89.6 per cent and a seedling count of 1.6. The recovery on the basis of total seed units and viable seed units amounted to 84.4 and 83.7 per cent, respectively. Further experience with this unit brought the recovery up to 60 per cent by weight, during the production of some 520,000 lb of finished seed. Recoveries, by weight, of 65 to 70 per cent are accomplished when the seed is reduced only to the 10-7 size.

Seed processed in the above manner is superior to segmented seed in every respect, except one, namely, singleness of germ, and this may prove to be an advantage. Comparative laboratory germination trials showed that seed processed by segmentation produced 1.2 to 1.4 seedlings per viable seed unit as compared to 1.5 to 1.6 for decorticated seed. The size of the seed was the same for both processing methods. This was fortunate in that equipment adapted to plant one would handle the other. In addition to a marked improvement in the recovery of seed during the new processing operations, the new product germinated equally as well as the original seed, was less sensitive to planting depths, and did not produce as many abnormal plants. The processed seed has a smoother exterior than either segmented or whole seed and is more dense, which improves its flow through planting equipment.

TABLE 2. AN ANALYSIS OF PRELIMINARY RUNS CONSISTING OF 5-1000-LB SAMPLES PROCESSED BY COMBINATION OF BURR REDUCTION AND DECORTICATION

Seed reduced to 9-7 size

Germination Normal	Germination Abnormal	Seedlings per seed unit 1	2	3	4	Seedlings per viable unit	Seeds per pound	Per cent recovery Weight	Number	Viable units
					Whole					
90.4		25.0	47.3	15.3	2.8	1.9	28216	100	100	100
					Processed					
89.6	1.9	35.8	48.8	4.8	0.2	1.6	42492	56.0	84.4	83.7

Whole seed weighs 18 to 22 lb per bushel. After decorticating, cleaning, and grading, it weighs 30 to 35 lb per bushel. Inasmuch as 35 to 45 per cent of the original weight is lost during the process, and its unit weight is almost doubled, the volume occupied by decorticated seed amounts to about one-third that of the whole seed from which it was produced.

The improved emergence, under field conditions, for the decorticated seed was reflected in comparative trials with segmented seed made from the same lot of whole seed, Table 3. Precision-planting equipment was used to drop the seeds uniformly at the rate of 4 or 5 per foot. The decorticated seed showed 1.6 seedlings per viable unit (40 per cent singles) as compared with 1.13 (87 per cent singles) for the segmented seed in the laboratory germination. The plantings were made under several moisture conditions, resulting in a wide range of field emergences. Stand counts made on plantings produced under the best conditions revealed field emergences of 88.2 per cent and 70.4 per cent, respectively, for decorticated and segmented seed. The former produced 47 in with singles and 37.7 in with doubles, as compared to 50.2 and 9.0, respectively, for segmented seed when based on 100 seed units planted. Under less favorable conditions, the field emergence was 35 per cent and 19 per cent, respectively, for decorticated and segmented seed. The former produced 24.8 in with singles and 10.67 in with doubles, as compared to 12.55 and 2.43, respectively, for the latter. It can readily be seen that on the basis of the same number of seed units planted, decorticated seed produces as many or more inches with single seedlings than does segmented seed having an extremely high proportion of single germ seed units. It is evident that the percentage of inches with single plants is higher for the segmented seed, yet the number of single plants available at thinning time may be greater in decorticated seed plantings.

**Formerly associate in agricultural engineering, University of California, now agricultural engineer, Spreckels Sugar Co.

TABLE 3. FIELD EMERGENCE ON BASIS OF 100 SEED UNITS PLANTED

(Segmented vs. decorticated with laboratory germinations showing 87 and 40 per cent singles, respectively. Seed size, 9-7. Varying degrees of emergence. Four replications each planting. Average of twenty-four 100-in counts each replication)

Seed	Pounds per acre	Seedlings per inch 1	2	3	4	Total inches with plants	Percentage inch singles	Percentage field emergence
			First planting					
Segmented	2.62	50.2	9.0	0.59		59.79	83.9	70.4
Decorticated	3.27	47.0	37.7	1.76	0.17	86.63	54.8	88.2
			Second planting					
Segmented	4.02	22.1	4.2	0.63	0.12	27.05	81.6	33.2
Decorticated	3.72	32.2	15.95	0.71		48.86	65.9	48.4
			Third planting					
Segmented	4.12	12.55	2.43	0.12		15.10	83.2	19.0
Decorticated	3.90	24.8	10.67	0.37		35.84	69.2	35.0

Relative rates of emergence of whole, segmented, and decorticated seed were determined under various soil moisture and temperature conditions[5]. The only real differences came at the lower levels of soil moisture. For example, the test run at 9 per cent soil moisture and 50 F showed germination of decorticated seed 56 per cent complete at the end of 20 days as compared to 20 per cent for segmented seed and 14 per cent for whole. Such differences could mean the difference in obtaining a stand of beets under unfavorable germination conditions.

Sugar beet seed processing should be considered only as a temporary measure to overcome some of the obstacles of using whole ungraded beet seed. Plant breeders are making definite progress toward the production of single and double-germ seed. In the light of tests reported in this paper and those conducted in other sections of the country, it is evident that industry does not want single-germ seed unless it can be developed to the point of giving better field emergence. The chief reason for most seed processing is to prepare the seed for precision planting. For the time being, at least, it is necessary to reduce the size of the seed to the point where its variation does not exceed 3/64 in if available precision planting equipment is to be used. No doubt some polishing will still be required when the plant breeders are ready to release the new seed, in order to facilitate precision planting. This can be accomplished through a light decortication.

REFERENCES

1 Bainer, Roy. Seed Segmenting Devices. Proc. American Society Sugar Beet Technologists, third general meeting, pp. 216-219, 1942.

2 Bainer, Roy. New Developments in Sugar Beet Production. AGRICULTURAL ENGINEERING, vol. 24, no. 8, pp. 255-258, August, 1943.

3 Bainer, Roy. Precision Planting Equipment. AGRICULTURAL ENGINEERING, vol. 28, no. 2, pp. 49-54, February, 1947.

4 Bainer, Roy, and L. D. Leach. Processing Sugar Beet Seed by Decortication, Burr Reduction and Segmentation. Proceedings American Society Sugar Beet Technologists, fourth general meeting, pp. 625-639, 1946.

5 Leach, L. D., Roy Bainer, and L. D. Doneen. Emergence and Rate of Emergence of Sugar Beet Seed as Influenced by Seed Preparation, Soil Moisture and Temperature. Proceedings American Society Sugar Beet Technologists, fourth general meeting, pp. 107-116, 1946.

The International Sugar Beet Harvester

By J. L. Hipple
MEMBER A.S.A.E.

THE International sugar beet harvester which is being offered to the trade this year, presents some improvements over the 1947 machine, although there is no basic change in the machine itself. Counting our 1948 production, we will have 2700 of these machines in operation in three years from its introduction.

In 1947 we started one of our production machines in the Imperial Valley in California in May, and it ran through November harvesting over 5000 acres of beets in all kinds of soil. This machine averaged 6½ tons of beets per acre of operation and harvested one acre of beets every 2½ hr of operation.

The changes found desirable in that test run were incorporated in the 1948 machines. Most important of these were the floating top flinger drum and heavier drive chains, also the inclusion of a master slip clutch on the belt pulley shaft as additional protection to all moving parts from overload. The floating top flinger drum is, we believe, a great improvement since it allows this unit to raise up and relieve itself when a heavy mass of vegetation is encountered.

Last year we tested a top conveyor for taking the tops from the flinger and delivering them out beyond the tractor wheel. This unit worked satisfactorily, but the cost of it was beyond what we thought the user would pay.

Last year some of the owners of our machine windrowed four rows of tops in one windrow by moving the baffle curtain into different positions and pulling these beets in four-row lands. We provided a change in our curtain mounting this year so that it can be shifted to three positions from the tractor seat. As you know, we use the revolving disk for a topping medium since no amount of trash or vegetation seems to affect its operation. The amount of crown taken off is regulated by a drag-type finder that provides for differential topping of large and small beets.

The idea of differential topping is old. One particular patent with which I am familiar was issued to a G. F. Conner in 1907. There are other subsequent patents covering different methods of accomplishing this. In light soils and where the beets project up out of the ground to a considerable height, some difficulty has been found where the drag-type finder would push the beets over, resulting in unsatisfactory topping.

We had experimented with a driven finder unit in our early tests but by reducing the weight of our topper unit have stayed with the drag finder. We are testing this year two types of driven finders with a view of adopting one of these for the 1949 machines.

The problem of mechanical clod separation is still with us. We are still hoping for a solution. Our hope is to find something that will work as a unit in our present over-all design because we feel that there are conditions under which nothing will replace our present method, such as mud and frozen ground, and even under snow.

As stated before, this year we are continuing our practice of keeping a production machine running throughout the California beet harvest season, extending from early in May through November, moving it north with the harvest.

We welcome suggestions at any time from any source for improvements in our machine. We feel that the mechanical sugar beet harvester, whatever its make or design, is more than just a machine. It is a social and economic institution, and aside from its economic value to its producer, it presents an obligation to industry to do everything possible to further the mechanization of a basic crop.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Power and Machinery Division.

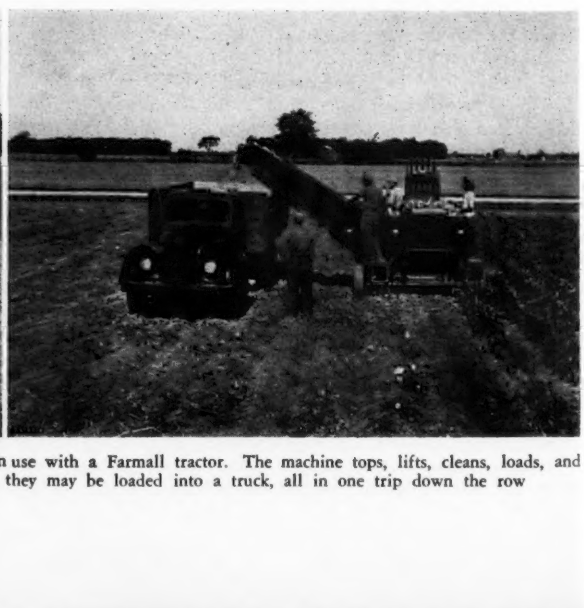
J. L. HIPPLE is manager of engineering, farm implement division, International Harvester Co., Chicago, Ill.

"Equipment for the Application of Herbicides"

THE senior author, N. B. Akesson, of the above-entitled paper published in AGRICULTURAL ENGINEERING for September, 1948, suggests that the following notation would be in order regarding Figs. 6 and 7 on page 388:

"As long as these charts are used as suggested in the text for finding the nozzle discharge in gallons per minute (gpm), with mph, nozzle spacing, and gallons per acre given, no difficulty will be encountered. However, the charts can be used for finding mph or gallons per acre with the other factors given, if the value taken from the charts is *divided* by the nozzle-spacing factor.

"Thus, when finding gpm the value from the charts is multiplied by the nozzle-spacing factor (corresponding to the spacing used), and when finding gallons per acre and mph, the chart value is divided by the correction factor. In either case when 18-in spacing is used, no correction is needed."



Two views of the International Harvester HM-1 sugar beet harvester in use with a Farmall tractor. The machine tops, lifts, cleans, loads, and transports the harvested beets to the edge of the field, where they may be loaded into a truck, all in one trip down the row

Development of the Marbeet Sugar Beet Harvester

By E. F. Blackwelder

THE Marbeet Harvester was first built in 1942 by a group of Sacramento Valley men and further developed during 1943, with the cooperation and assistance of California beet growers, processors and members of the University of California staff at Davis. We take pride in the fact that our harvester was the first machine to harvest beets commercially in this state on a large scale, and that it still is the unit most extensively used here.

During 1943, 35 single-row units were delivered and used, not, of course, without a great deal of mechanical trouble, but with the usual fine cooperation of the California growers, and tolerance by the processors, it was proven that sugar beets could be harvested practically by machinery.

In construction, our machine consists of a 6-ft wheel with a 10-in rim containing five rows of curved 3/8 x 3-in spikes spaced 2 in center to center, mounted on a swing frame supporting lifting plows which cut the tap root and then engage the beets on the spikes. The topping knives mounted between the rows of spikes at the top of the wheel sever the roots from the tops as the wheel is turned. The roots then tumble over a series of filter rolls slightly retarded by spring-loaded belt curtains, and then fall into a hopper from which they are carried by a potato chain-type elevator into a vehicle running alongside. The tops are cleaned from the wheel by a series of strippers mounted below the topping knives, allowing them to fall on to a cross conveyor which discharges them into a windrow. All of our large models which have been so extensively used in California are of the towed type carrying their own auxiliary engine.

Following the 1943 experience, many improvements were made and a two-row model was developed, of which forty were built. This improvement has continued during the past five years, and as a result we have manufactured and delivered 695 units, including standard single-row, junior, and two-row models. These machines were responsible for harvesting over 66 per cent of the beet acreage in California during 1947. There were 153,000 total acres harvested, so our equipment accounted for at least 100,000 acres of this total.

These large models have been tested throughout other beet-growing sections but with a small degree of acceptance, principally because of the large power requirement. There are very few track-type tractors used in these areas, where the average acreage per grower is much less than in California.

During 1947, we experimented with a tractor-mounted type known as "Marbeet Midget." We first demonstrated this model in the Imperial Valley before a group representing the Sugar Beet Development Foundation. It was so enthusiastically received by them that they demanded we build enough units for them to test in other areas. Eight were built and tested in practically every beet-growing section of the United States. Nowhere were we able to demonstrate as successfully as we did in the Imperial Valley, but in many instances we did a very acceptable job.

This model carries a 30-in diameter wheel with four rows of spikes, spaced as in the larger model, mounted on a spring-loaded swing frame which is hung in a main frame mounted on the right-hand side of a wheel tractor. The lifting plows are again mounted on the swing frame. We have been experimenting with several different plow designs and believe now that we have plows to meet all conditions. Two overlapping power-driven disks are used for topping. The roots are carried back along the side of the tractor to an elevator which loads them into a truck or into a trailer pulled by a tractor. The tops are again placed on a cross conveyor and windrowed.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Power and Machinery Division.

E. F. BLACKWELDER is manager of the Blackwelder Mfg. Co., Rio Vista, Calif.

One of these models is now commercially harvesting in the Imperial Valley and the reports coming in are highly satisfactory. This unit was redesigned as a result of the experience gained during the past season, and we are now confident that we will be able to furnish a harvester which will be readily acceptable to growers.

In addition to the harvesting of sugar beet roots, we are giving a great deal of attention to a top recovery program. So many reports have been given to emphasize the value of tops that beet growers are now insisting that equipment be developed to handle this byproduct. We have arranged with several progressive growers in California to cooperate with us in this development. We have found the usual fine spirit of cooperation among California farmers, and as a result, have about 500 acres of sugar beets on which to test our ideas and develop figures on which to base future top recovery programs.

In the first instance, we plan on using a fan-type suction method of pretopping, chopping, and loading the tops, which are to be taken immediately to the silo for storage. These tops will not touch the ground and will be in a clean, chopped condition and can be mixed with other material when ensiled, if desired. When the beets are harvested, the crowns will be windrowed, then picked up with a spiked drum and loaded into a truck and hauled to a chopper or direct to a storage space. There crowns could be ensiled with the tops and according to several authorities make a very desirable feed for livestock.

Another project we are to develop is the dehydration of chopped tops as recovered by the suction harvester. Although these green tops have been found to contain about 90 per cent moisture and may present a cost which will make this development prohibitive, we are arranging to follow this idea and expect to develop some practical information.

A third method is to use a green crop loader to preharvest and load the tops, then follow either of the above two methods in preparing them for storage.

All of these proposed studies are based on the fact that a great deal of food value is lost when the green tops are permitted to be sun-cured. We feel that, if a practical and economical method can be developed for the recovery and use of beet tops, a full harvest program can be offered to our beet growers, and we also believe that it will of necessity become a part of the regular beet-harvesting mechanization development.

An Item in Production Efficiency

FARMS and rural industries have one apparent efficiency advantage over urban industries which we have not seen adequately brought to public notice. It is in reduced transportation of workers between their homes and their work.

Commuting has increased tremendously in recent years. in numbers of people involved daily, in distance covered, and in time consumed.

While we have seen no statistics on the subject, it occurs to us that for many urban plants, transportation of people to and from work must represent a greater burden on the economy than the total transportation of raw materials and supplies from their sources, movement within the plant, and shipment of finished products to consumers. The transportation of people would be greater, we suspect, in gross ton-miles as well as in cost per mile.

We have no sugar-coated pill to offer the commuter, his employer, or the consumer, who all share the cost of this inefficiency in production. We do suggest, however, that with foresight and engineering planning, farmers and rural industries can make the most of their natural advantages in this phase of production economy.

The 1947 Mechanical Harvesting of Sugar Beets

Sugar Beet Harvesting in California

By Austin A. Armer
MEMBER A.S.A.E.

IN THE years following 1943, the mechanical harvest of sugar beets in California has followed a growth curve of such proportions as to point toward almost total mechanization in 1949. The factors influencing this rapid acceptance of mechanical harvest have been many and have changed with the passing of the years.

The original impetus to the adoption of harvesting machinery was imparted by the war-caused labor shortage, but other factors served to accelerate the acceptance of mechanical harvest during the postwar years. These are the factors which will receive special attention in this discussion.

The general scheme of mechanical harvest in California has gone through three phases. These are:

1 Renting of sugar beet harvesters by growers from processors
2 Acquiring of sugar beet harvesters by growers and commercial operators
3 Increased utilization of the services of commercial operators and a decrease in the number of harvesters rented or owned by growers.

The year 1947 definitely initiated the third phase. Commercial operators performed a large fraction of the total harvest, and their acceptance by growers has grown in proportion to their dependability and the quality of their work. At least five commercial operators so planned their 1947 program as to start in the earliest harvest district (Imperial Valley) and terminate in the latest northern California districts. Thus they were able to harvest close to one thousand acres with each two-row Marbeet harvester in this service.

Extent of Mechanical Harvest in California During 1947. It is unfortunate that the relatively accurate performance records maintained by processors during 1945 and 1946 were not continued during 1947. It would appear that since 1947 marked the passing of mechanical harvest from the first to the second and third phases, the details of this harvest were left up to the individual grower and commercial operator, with far less processor participation. Due to this lack of accurate record keeping by processors in 1947, it is not possible to present an accurate measure of the percentage of California's sugar beet acreage harvested mechanically in 1947.

The data derived from the records of processors and commercial operators, however, form a basis for the 1947 estimate, and it appears that very close to 69 per cent of California's 150,000 sugar beet acres were harvested mechanically in 1947. (This compares to 55.5 per cent harvested mechanically in 1946.) This 69 per cent figure has a probable error of plus or minus 2 per cent.

Types of Harvesters Used in California During 1947. The early acceptance of the Marbeet harvester in California has been maintained, with the result that this harvester accounted for by far the largest portion of the acreage harvested; approximate figures for various makes are Marbeet, 66 per cent; McCormick-Deering, 2 per cent; other, 1 per cent.

The Marbeet harvesters were divided into single and double-row types, the latter having been responsible for most of the mechanically harvested acreage in California. These harvesters benefited as a result of several minor improvements conceived principally by the sugar beet processors and executed by the Blackwelder Mfg. Co. There was a moderate acceptance by growers of the top windrowing attachment, the defoliator, and rear-mounted coulters. The agricultural engineering department of the Spreckels Sugar Co. developed these devices which were made available by the Blackwelder Co. There can be little doubt that these devices contributed to the acceptance of mechanical harvesters and served to accelerate their adoption in 1947.

The International Model HM-1 sugar beet harvester likewise benefited from minor improvements, and its utilization in 1947 was approximately double that of 1946.

Harvester Performance Improvement Necessary to Induce Complete Mechanization. With labor becoming constantly more available, the extent to which mechanical harvest becomes complete will depend to a large extent upon the mechanical perfection of the machines. Whereas those growers availing themselves of commercial operators do not concern themselves greatly with the operating inconveniences of existing harvesters, they are directly concerned with the performance of the machines in regard to quality of topping and field losses. These two items, therefore, remain the subject calling for the most attention on the part of harvester manufacturers in the immediate future. Needless to say, these manufacturers are well aware of these requirements and are exerting much effort toward improving their machines. The processors likewise are mindful of the contribution they can make and will undoubtedly contribute to the early future improvement of harvesting equipment.

Impairment of Harvester Efficiency by Adverse Field Conditions. The prediction that 1949 will see almost complete mechanization in California is clouded by the fact that California's cultural practices frequently tend to produce sugar beet fields in which mechanical harvest is very difficult. Foremost among the difficult field conditions encountered is the prevalence of weeds at harvest time.

The presence of weeds in sugar beet fields is certainly not intended by California growers; neither is it permitted when circumstances make it economically possible to minimize weed growth. It is the economical limit of weed control which will continue to act as an inhibiter to complete harvest mechanization and which may conceivably contribute to the continued use of hand labor in a few fields.

Weather will continue for some time as a deterrent to complete mechanization. While certain years present harvest periods practically devoid of rainfall, there always exists the hazard of a wet fall, during which mechanical harvesters of existing types must be assisted by hand labor.

Those concerned with the eventual complete mechanization of the California sugar beet harvest must therefore assume the obligation to concentrate on the redesign of harvesting equipment to cope with the weed problem, as well as to bend every effort toward developing harvester improvements such that reasonably high field recovery can be accomplished under the many soil conditions encountered throughout the state.

To this end processors and harvester manufacturers alike have pledged their cooperation, and if predictions are in order, it appears that eventual complete mechanization will not be hindered by technical problems.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Power and Machinery Division.

AUSTIN A. ARMER is agricultural engineer, The Spreckels Sugar Co., Sacramento, Calif.

Sugar Beet Harvesting in the Intermountain Area

By Rowland M. Cannon
MEMBER A.S.A.E.

IN THE preparation of this review, the intermountain area has been extended to include the sugar beet-growing areas of Washington, Oregon, South Dakota, North Dakota, Minnesota, Iowa, and Nebraska, as well as the mountain states

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Power and Machinery Division.

ROWLAND M. CANNON is agricultural superintendent, Utah-Idaho Sugar Co., Chinook, Mont.

of Colorado, Wyoming, Montana, Idaho, and Utah. The reason for including some of the states that may seem outside the intermountain area is that conditions in those states are very similar to those encountered in the mountain area and they are served by the same processors operating in the mountain states.

In the fall of 1947, nearly 3,000 mechanical beet harvesters operated in the sugar beet-growing sections of these states. Approximately 55 per cent were John Deere, 31 per cent International, 3 per cent Scott-Urschel, and 3 per cent Kiest machines. The remaining 8 per cent of the harvesters in operation was an assortment of various makes and models and including a large number of beater toppers manufactured either by local blacksmith shops or by the Olsen Mfg. Co. of Boise, Idaho.

These machines harvested approximately 130,000 acres of beets, or about 21 per cent of the sugar beet crop in this area.

The John Deere harvester was first among the various makes of machines in use, harvesting approximately 45 per cent of the acreage handled mechanically. The International machines took care of about 38 per cent, Scott-Urschel approximately 4 per cent, Kiest, Marbeet, and a number of other makes combined to account for 3 per cent, and approximately 10 per cent of the mechanically harvested acreage was topped with beater toppers of various sorts.

The output per machine varied greatly in different areas and with different makes of machine. On the average, the International had the greatest output of the more common machines with an average of 58 acres per machine. The Scott-Urschel accounted for 53 acres per machine.

The average acreage per machine was the greatest in the states of Montana, Minnesota, and North Dakota, with the average in these areas being 59 acres per machine. In Utah, the average was 48 acres per machine, with Washington, Wyoming, and Colorado averaging between 40 and 45 acres per machine, and the average for Nebraska being 39 acres per machine. The average output per machine in the Idaho-Oregon areas has been reported to be high but definite values were not available at the writing of this paper.

USE OF MACHINES DEPENDENT ON SOIL CONDITIONS

For the most part, the use of various types of machines has been dependent upon soil conditions and other variables, with one machine finding great favor under one type of condition, and another fitting in better somewhere else.

The John Deere harvester has proven to be most satisfactory in the lighter soil types. Its use has been almost completely discontinued in soils that tend to break up cloddy, due to its inability to separate clods from beets.

John Deere harvesters have possibly found their greatest acceptance in the North Platte Valley of Nebraska, the Lower Snake River Valley of Idaho and Oregon, and the Yakima Valley of Washington. A number of these machines is in operation on the lighter soil types through Colorado, Utah, and some parts of Montana and Wyoming. The capacity of the John Deere machine has been somewhat lower than that of some of the other machines, although operating costs have compared favorably.

The International topper was introduced for large-scale use in the fall of 1946 and found immediate acceptance in practically all of the areas having heavier soil types where the John Deere machine was not suitable. It was also well received in most of the other sections of the intermountain area. In the heavier soil types, it has been necessary in practically all cases to use the sorting belt which carries beets and dirt over the trailer-hopper. This requires two or three men making a hand separation of the beets from the clods. This type of operation has proven to be entirely economical, however, and has met no serious objection. In lighter soil types, it has not been necessary to make a hand separation of beets from dirt, which of course has resulted in somewhat lower operating costs.

The Scott-Urschel sugar beet combine, manufactured by the Scott-Viner Company of Columbus, Ohio, was developed in the eastern sugar beet areas and has been used extensively in that part of the country for some time. The machine was introduced into the intermountain area experimentally in 1946 and a number of machines went through the 1947 harvest principally in the Colorado, Milk River Valley of Montana, and Belle Fourche, South Dakota, areas. It proved to be entirely satisfactory for most conditions encountered in these areas and had the advantage of being able to harvest beets from heavy soils without the necessity of any hand operation. This machine has the further advantage of being adaptable to any tractor having suitable power and wheel or track spacing.

The Scott-Urschel harvester has a high capacity. While it is a one-row machine, the speed of forward travel up to 4 mph is limited only by the power of the tractor. A number of these machines operated at speeds of 3½ to 4 mph and did an entirely acceptable job. The forward speed with both the International and John Deere machines should not exceed about 2¾ mph for good results.

A number of Kiest harvesters was distributed through much of the intermountain area for use in the 1947 harvest season. In many cases, these machines did not operate at all, and where they were used, the cost of operation was rather high due to a great deal of mechanical trouble. There were very few cases where the lifter-loader delivered acceptable beets in the heavier soil types.

BEATER TOPPING OF BEETS DEVELOPED IN IDAHO

In the Boise Valley and Lower Snake River Valley of Idaho, the conception of beater topping was developed in the fall of 1946. The tops were removed from the beets with flails of rubber or cable extending from a shaft rotating at high speed. A number of beaters of various sorts has been manufactured by local blacksmith and machine shops throughout that area, and the Olsen Mfg. Co. of Boise manufactured the "Rotobeater" for commercial distribution in the fall of 1947. The use of this harvesting system extended somewhat into northern Utah and Washington.

A number of devices was used to lift and load beets following beater topping. In many cases the Kiest two-row lifter-loader was used and in some cases a one-row lifter-loader built by the Olsen people was used. Very often beater toppers were used in conjunction with John Deere or International harvesters. For the most part, the harvest system involving beater topping was confined to the lighter soil type areas and to areas where beet tops have not been fully utilized for livestock feed.

The more successful harvesters operating in this area have operated successfully in both wet and dry field conditions. Many machines of several makes operated in weather and field conditions where hand labor would not work. The International and Scott-Urschel machines harvested beets satisfactorily in wet fields as long as the tractor could keep going. Several machines harvested beets from fields having a sizable snow covering.

Some of the machines which have found great success in other areas — notably the Marbeet — have not been successful in the intermountain area because of their limitation to operating in dry fields.

In many instances, the average performance of various harvesters is not a true measure of the ultimate capacity of a machine. In the Chinook factory district of Montana, 33 International machines harvested an average of 89 acres each, as compared to an average of 58 acres for all machines in the intermountain area. Seven of these machines harvested almost 1000 acres. One machine harvested 125 acres of beets in the period from October 1 to November 2. Another International machine harvested 113 acres for three different owners. The first owner started his harvest on Sept. 23 and completed his 36 acres on October 5. It was sold to a man who took out 7 acres in the next two or three days, and upon the completion of his harvest, he again sold it to a grower who started the harvest of 70 acres on October 9. He completed his harvest on October 28 with an average of 3.7 acres, or 44 tons per day. Incidentally, his direct costs were $10.28 per acre, or 86 cents per ton. It would have cost this grower about $2.50 per ton for labor and gasoline to do the job by hand.

Eighteen Scott-Urschel harvesters, operating in the Chinook

factory district, averaged 61 acres per machine. Four of these units exceeded the 100-acre mark. One particular machine harvested 105 acres of beets, giving an average of 3.5 acres per day at a cost of 93 cents per ton. This cost was attained on an average yield of less than 9 tons per acre.

Throughout the intermountain area, countless machines have harvested in excess of 100 acres in an average harvest season. Attaining this record requires considerable planning and necessitates working long hours, but it is certainly within the province of any sugar beet grower to attain production of this sort from a mechanical harvester.

An extensive survey conducted by the Utah-Idaho Sugar Co. on mechanical harvester operation indicates that 296 machines harvested 216,395 tons from 15,590 acres at an average direct cost of 83 cents per ton. These records represent about 87 per cent of the total number of harvesters in operation within the areas served by the company in the five states in which it operates.

A conservative estimate of the cost of hand harvest on this acreage would average nearly $2 per ton for hand labor alone. When the cost of lifting the beets and providing supplies for the hand labor is added to this figure, it would approach $2.50 per ton, indicating an average saving of over $1.60 per ton where machines were used. These machines averaged 731 tons each which would represent a saving of about $1200 per machine over doing the job by hand. A saving of this sort would pay for a machine such as the John Deere, International, or Scott-Urschel in two years' operation. Many individuals paid for their machines in one year's operation where they were kept busy throughout the harvest season in an efficient manner.

In the fall of 1946, less than 10 per cent of the acreage in Montana was harvested mechanically. In 1947, over 25 per cent of the state's acreage was harvested mechanically, with indications that over half of it will be harvested mechanically in 1948. The increase in mechanical harvest has probably been somewhat faster in Montana than some of the other beet-growing areas, but it serves to illustrate the manner in which mechanical harvest of sugar beets is being accepted in the intermountain area.

AUTHOR'S NOTE: The author wishes to acknowledge statistics and other information provided by Vernal Jensen, Amalgamated Sugar Co.; A. W. Skuderna, American Crystal Sugar Co.; P. H. McMaster, Great Western Sugar Co.; E. P. Pattison, Holly Sugar Corp. He has also referred to data included in a paper presented by P. H. McMaster before the 1948 meeting of the American Society of Sugar Beet Technologists, and in the booklet, "Machine Harvest Marches On," published by the Utah-Idaho Sugar Co.

Sugar Beet Harvesting in the Eastern Area

By P. A. Reeve

DURING the fall of 1946, 130 mechanical sugar beet harvesters operated in the area represented by the Farmers & Manufacturers Beet Sugar Association, which normally grows 240,000 acres of sugar beets in the sugar beet producing parts of Michigan, Ohio, Wisconsin, Illinois, and Ontario, Canada. Of this number of machines, 120 were Scott-Urschel harvesters, which handled 8,077.9 acres, or 67.3 acres per machine. One Marbeet, Jr. harvester was used on 72 acres, and the others on about half that acreage per machine.

In this same area, in 1947, 256 Scott-Urschel harvesters and 42 of other makes were used. The Scott-Urschel machines were used on an average of 58.13 acres per unit.

A breakdown of Scott-Urschel harvester operations in 1947 by year model indicates a progressive increase in acreage capacity as follows: Regular chain (1945), 43.08; regular chain (1946), 53.9; regular chain (1947), 62.7; regular V belt (1947), 74.41, and stub bar, V belt (1947), 87.2.

Data from four factory areas show most users (59) direct loading from the harvesters into trucks or wagons, and handling 60 acres per harvester by this method. A smaller number (25) using Scott-Urschels equipped with sidedump carts, handled 74.0 acres per harvester.

Cost of repair parts for 193 Scott-Urschel machines for the 1947 season averaged $1.39 per acre. These figures do not include welding costs or costs of parts bought by farmers from outside sources, such as bolts, chain, etc. Also, these figures do not take into consideration the inventory of parts which the farmers might have on hand.

The beet sugar companies of the eastern area are ordering all stub bar sugar beet combines for 1948.

The advantages of the stub bar over the regular Scott-Urschel are, the simplified lighter machine with fewer moving parts, lower maintenance cost, and lower operational cost.

Information furnished by the American Crystal Sugar Co., as to Scott-Urschel sugar beet combine performance in 1947, shows 49 to 106 acres and 302 to 999 tons harvested per machine for 5 machines, with averages of 78.33 acres and 677.8 tons. Labor at 80 cents per hour, parts, welding, fuel, and oil gave total operating costs from $7.07 to $4.76 per acre, with an average of $5.63. Two units handling the highest acreages, with low costs per acre and working in fields yielding over 9 tons per acre, each showed a cost per ton of 51 cents. The highest cost per ton, 90 cents, was by a unit with an average cost per acre, but working in beets averaging 6.37 tons per acre.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers, at Portland, Ore., June, 1948, as a contribution of the Power and Machinery Division.

P. A. REEVE is agricultural supervisor, Farmers and Manufacturers Beet Sugar Assn., Saginaw, Mich.

This 36x205-ft Rilco barn on Leatherwood Farms, near Bluefield, West Virginia, is understood to contain the largest barn hay-drying system ever built

Essential Characteristics of Durable Concrete Draintile for Alkali Soils

By Philip W. Manson and Dalton G. Miller

MEMBER A.S.A.E. FELLOW A.S.A.E.

IN the spring of 1919 failures of concrete draintile were reported to have occurred in several drainage systems in southwestern Minnesota. A systematic field study was begun the same fall and covered 23 counties in Minnesota and 4 counties in northern Iowa. A number of tile failures were located (Fig. 1), and samples of drain water, soil water, and soils were taken by representatives of what was then Drainage Investigations of the Bureau of Public Roads, U. S. Department of Agriculture, and later analyzed by the Bureau of Soils of the Department. The early studies revealed a marked correlation between concentrations of soil alkalies and the tile failures. Largely as a result of these field studies, an act of the 1920 session of the Minnesota Legislature provided funds for the creation of a laboratory in the agricultural engineering building on the farm campus of the University of Minnesota. This paper is based on work of the laboratory.

The experiments reported upon here were planned to aid in the general improvement of farm draintile, but many of the conclusions have a wide application to the use of concrete culverts, water and sewer pipe, irrigation structures, foundations, and all other types of concrete construction that, in service, must resist the action of soils or waters rich in sulfates.

It is not the intention in this short paper to enter into a detailed discussion of the problems of soil sulfates and concrete resistance. Therefore, only a few of the outstanding results will be reviewed. The more detailed final report, now in preparation as a bulletin, will cover all phases of this work.

CONCLUSIONS

In the design of mixes for concrete to be exposed to soil sulfates, the first considerations for durability must be high unit strength and low permeability. This holds for all types of concrete structures including draintile and concrete products in general. It is only as the 28-day compressive strength of normally cured concrete approaches 5000 psi that resistance can be of a high order. The concrete must be well placed so there will be no honeycombing as deleterious action will always start first at such points of weakness regardless of all other considerations.

From here on there are four lines of approach for increased durability. Some of these are feasible for most types of construction, others for products only. These are enumerated and considered in the inverse order of importance.

1 *Surface Coatings.* The limited research done at Minnesota relative surface coatings does not warrant any assumption other than that surface coatings at best are but temporary expedients, how temporary depending upon the water tightness and durability of the coating material.

2 *Admixtures or Additions.* This field has been widely explored by many research workers without being productive of tangible evidence that admixtures in concrete have much to offer for increasing sulfate resistance. Most products of this type decrease resistance, some have little or no effect, while the best of them rarely do more than to slightly increase the resistance of concrete made of low sulfate-resisting cements. Results at Minnesota with the organic oils derived from flax, soybeans, and the nuts of the tung tree indicate that additions of this type may be exceptions to the rule because each of these three oils gave positive results in just about all cases where 1, 2, or 4 per cent oil was added to cylinders cured normally and cured at temperatures of 100 and 135 F. A complete review of the admixture phase will be given in the final report already mentioned.

3 *Curing Conditions.* The durability of concrete made from cements low in sulfate resistance is improved by air hardening.

Tests conducted over a period of 26 years show that the sulfate resistance of concrete is remarkably increased by curing in water vapor at temperatures ranging upward from 212 F. Curing in water vapor at elevated temperatures below 212 F has little or no effect on sulfate resistance.

Table 1 shows a few of the many compression tests made of concrete steam cured at 212 and 350 F and stores in tap water and Medicine

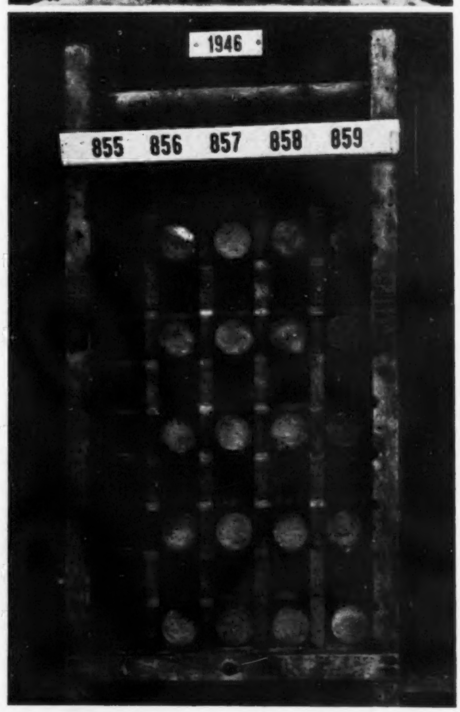


Fig. 1 (*Top*) Exterior of a 30-in draintile exposed 4 years in soil carrying 2.2 per cent of sulfate salts. No effort had been made to produce sulfate-resistant tile at the time these were made • Fig. 2 (*Bottom*) Cylinders cured in steam at 350 F, for short time periods, followed by exposure in Medicine Lake for 17 years. Cylinders in Series 855 received no steam curing and failed after exposure for 3 years

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Soil and Water Division. It is a report of work conducted under a cooperative agreement between the Division of Agricultural Engineering of the University of Minnesota, the Public Roads Administration of the Federal Works Agency and the Division of Water Resources and Engineering of the Minnesota Department of Conservation. In 1946 and 1947 the graduate school of the University of Minnesota allocated limited sums of money to aid in the preparation of reports. In the files of the University of Minnesota, this is Paper No. 2412, Scientific Journal Series.

PHILIP W. MANSON is professor of agricultural engineering, University of Minnesota. DALTON G. MILLER is materials engineer, Public Roads Administration, Federal Works Agency.

TABLE 1. COMPRESSION TESTS OF 2x4-IN CONCRETE CYLINDERS CURED IN WATER VAPOR AT TEMPERATURES OF 212 F AND 350 F AND EXPOSED TO THE ACTION OF THE SULFATE WATER OF MEDICINE LAKE, SOUTH DAKOTA, COMPARED WITH SIMILAR CYLINDERS STORED IN TAP WATER IN THE LABORATORY. A LOW SULFATE RESISTANT CEMENT WAS USED IN THESE TESTS

(Note: All values are pounds per square inch)

Time in water vapor, hr	Tap-water stored specimens: Cured at 212 F			Cured at 350 F			17-year Medicine Lake specimens	
	7 days	28 days	5 years	7 days	28 days	5 years	212 F	350 F
0	3230	4720	7110	3840	5310	6560	0	0
¾	3020	2880	6300	1670	1940	5930	0	7480
1½	2590	2400	7330	2500	2800	7170	0	9160
3	2890	3130	6550	3210	3310	7110	0	9300
6	3220	3470	6920	3110	3540	5700	0	6740
12	3570	3580	7070	3280	3470	4390	0	5620
24	3960	4190	6850	3830	3840	5210	6690	6070
48	4360	4670	6580	3530	4710	5490	5320	7230
96	4330	4990	6950	4140	4320	5850	8030	6750
192	5180	6050	5500	3770	4260	4970	7750	7180

Lake. It will be noted that the higher the temperature (above 212 F), the shorter the curing period required for resistant concrete.

Fig. 2 illustrates the improvement made in the sulfate resistance of concrete exposed in Medicine Lake by the use of high-temperature curing. A low-resistant portland cement was used in these tests. Series 855 is the comparison series and received no steam curing. This series failed after about two years' exposure. Series 856, 857, 858, and 859 received ¾, 1½, 3, and 6 hrs, respectively, of steam curing at a temperature of 350 F. These cylinders show only slight action after 17 years' exposure. Compression results are recorded in Table 1.

4 *Chemistry of the Cement.* It is in this field where by far the greatest progress has been made in recent years, for without question the chemical composition of the cement itself influences to a great degree the performance of concrete exposed to soil sulfates. This has been proved so many times that it is now accepted as a fact and standard specifications have been written for sulfate-resisting cements in both the United States and Canada, the essential provision being maximum limitations on the per cent of the calculated compound tricalcium aluminate. Fig. 3 is a graph based on tests of 106 commercial cements plotted in the descending order of their sulfate resistance as determined by 10-year tests of concrete exposed to 1 per cent solutions of magnesium sulfate, 1 per cent solutions of sodium sulfate, and Medicine Lake. The graph shows a close correlation between the sulfate resistance of the cements and the calculated compound, tricalcium aluminate (C_3A). There were twenty of the 106 cements in which this calculated compound (C_3A) did not exceed 5.5 per cent. All twenty of these cements were among the forty most resistant of the 106 cements. It should be noted that each of the ten most resistant cements of group 1 had a C_3A value of less than 5.5 per cent. It should also be noted that of the twenty most resistant cements, 18 of the cements had a C_3A value of less than 5.5 per cent. The continuous dark line of Fig. 3 shows how the average tricalcium aluminate compound increases for the low-resistant cements. There are numerous

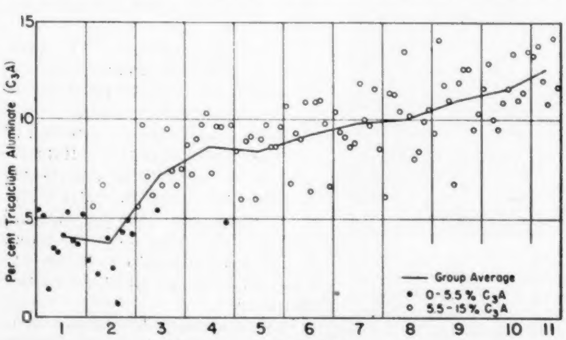


Fig. 3 One hundred six commercial cements arranged in descending order of sulfate resistance

standard portland cements on the market that are fairly low in tricalcium aluminate and can be purchased at no extra cost. It is not always simple to modify a standard cement so as to make it sulfate resistant, but it usually can be done where sufficient demand exists for such a cement. Cement Type V of the American Society for Testing Materials, Standard Specifications C 150-46, is a sulfate-resisting cement for which there are standard specifications. Types IV and II of the same specifications are moderately sulfate resistant and are suitable for use in concrete where exposure conditions are not too severe.

Fig. 4 illustrates how greatly standard portland cements may vary in sulfate resistance. Tests at Minnesota show that the life of concrete, when exposed to sulfate waters, may vary up to 2,000 per cent as a result of chemical differences in the portland cement used in the mix.

Getting out of the field of true portland cements there are (A) pozzolanic cements and (B) high alumina or aluminous cements.

(A) The pozzolanic cements are high in silica (SiO_2) with this oxide running mostly from 30 to 35 per cent instead of 20 to 22 per cent as in the standard portlands. Also, the lime content of the pozzolanic cements is generally only 40 to 50 per cent instead of around 62 per cent as with stand-

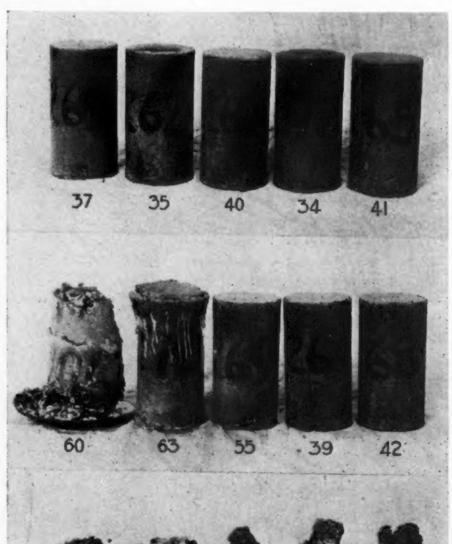


Fig. 4 A representative cylinder from each of 15 series, made with different brands of standard portland cement, after 15 months in 1 per cent sodium sulfate solutions

Fig. 5 The Medicine Lake crates were brought to shore annually and the cylinders examined, photographed, and some removed for compression tests

ard portlands. It is the rule that concrete made of pozzolanic cements displays high resistance to sodium sulfate, but not better than average resistance to magnesium sulfate.

(B) The high alumina or aluminous cements are distinctly different products from standard portland cements. They are much lower in lime and very much higher in alumina. Where the standard portlands ordinarily carry around 62 per cent lime and 5 to 10 per cent aluminum oxide, the high alumina cements carry only 25 to 40 per cent lime and around 40 per cent aluminum oxide. By far the most resistant specimens exposed to the sulfate water of Medicine Lake were those made of high alumina cements. High alumina cement cylinders of 1-3 mixes by volume were so resistant that after 23 years in Medicine Lake, neither by visual appearances nor by strength tests, do they give indication of appreciable deleterious action.

HOW TO MAKE SULFATE-RESISTANT CONCRETE DRAINTILE

If the mixing-water factor is considered separate from the compactness factor, then there are six basic requirements necessary for the manufacture of concrete draintile of the smaller diameters, made on the "packer-head" machines if they are to give satisfactory service in sulfate soils.

1 *Well-Graded, Sound Aggregate.* The essentials of good grading for the dry mixes used in the manufacture of draintile may be expressed briefly as not less than 40 per cent of the aggregate should be retained on the No. 8 sieve with possibly about 25 per cent of the aggregate on the No. 4 sieve.

2 *Sulfate-Resistant Cement.* Concrete tile that are to be exposed to sulfate waters should be made using a sulfate-resistant cement. The life of tile under sulfate exposure may be increased up to twenty times by the use of a sulfate-resistant cement. Many standard portland cements on the open market are sulfate resistant to a high degree.

3 *Rich Mixes.* It is doubted that draintile of the smaller diameters, with normal wall thicknesses, can be made on the packer-head-type machines in common use which will have strengths that will range upward from 1,600 lb per linear foot unless the ratio of cement used approaches 1 to 2½ by volume.

4 *Mixing Water.* The tendency in making dry-tamped concrete products where the forms are stripped immediately is to use too little mixing water. The object of this dry mix is to secure concrete that will not stick to the mold, or slump when the molds are removed. By using the proper amount of water, which is usually considerably more than that normally added, the quality of the concrete can be greatly benefited and without an increase in the slump. In other words, avoid making dry-tamped concrete drain of mixes too far on the dry side.

5 *Adequate Compactness of the Materials at the Machine.* The proper proportions of aggregate, cement, and water does not insure high strength concrete. This combination of materials must be thoroughly compacted when formed into a draintile. Often not enough thought is given to the care of the machine that packs the concrete. Frequent replacements with new, or rebuilt, shoes are necessary on the packer head. Tests in the laboratory have shown that a good concrete mix, poorly tamped, may give strength tests as low as 500 lb per linear foot of tile, and absorptions as high as 15 per cent, when the same materials, properly tamped, may yield tile strengths of 3500 lb per linear foot with absorptions as low as 3.5 per cent.

6 *Curing.* It is of particular importance that concrete draintile be well cured before they are installed in sulfate soils as resistance is of a much lower order for poorly cured concrete than it is for concrete which has had ample moist curing followed by hardening in air for as long as practicable. It is not good practice to install concrete tile at an age much under 30 days. If the cost can be justified, concrete tile that are to be subjected to severe sulfate attack should be steam-cured at least 6 hr in steam at 212 F, preferably higher.

Concrete tile properly made can be expected to have supporting strengths from 1,500 to 2,000 lb per linear foot and absorptions, oven-dried and boiled 5 hrs, under 8 per cent. The concrete in the walls of such tile will have 28-day compressive strengths ranging from 3000 to 5000 psi. The American Society for Testing Materials, Standard Specifications for Concrete Irrigation Pipe, Designation C118-39, has requirements essentially of this type. It should be noted here that the supporting strength requirements indicated for draintile are on the basis of "sand bearing" tests, whereas irrigation pipe requirements are on the basis of "3-edge bearing" tests and need be multiplied by the factor 1.5 to convert to "sand bearing" test results.

DETAILS OF PROCEDURE

No fewer than 100,000 test specimens were made for these studies. Most of them were cylinders 2 in in diameter and 4 in long. The 2-in diameter roughly approximates the wall thickness of many of the tile used in the mains of public ditches.

The concrete cylinders were made of aggregates screened to produce a fineness modulus of 4.67. Dry-rodded, this material weighed 124 lb per cu ft. The mix in a large proportion of these cylinders was 1:3 by volume and the general practice was to use dry mixes having around ½-in slump. The water-cement ratios were mostly between 0.62 to 0.66, about 4.75 gal of water per rack of cement. The 28-day compressive strengths of these concrete cylinders was between 4500 and 5500 psi. Oven-dried at 230 F followed by 5-hr boiling, when 21 days old, the cylinders had an absorption around 6 per cent.

In addition to the concrete cylinders, some were made of Ottawa standard sand, fairly well approximating poorly graded sand all too often used in the manufacture of concrete draintile. Such cylinders had 28-day compressive strengths around 2500 psi and absorptions around 10 per cent.

It was the general practice to make the cylinders in batches of nine and each series consisted of five or six batches made on different days of the same week. With but few exceptions the test results reported are averages for five cylinders, each from a different batch.

In addition to the cylinders, there were made many lean-mortar bars, mortar briquets and draintile of 5 and 6-in diameters, the thought being to cover just about the whole range of mixes which might be used in the manufacture of concrete draintile.

EXPOSURE CONDITIONS

It was planned originally to base conclusions on tests of cylinders stored in artificial solutions in the laboratory. However, as the work progressed it became evident that this procedure was very expensive and ignored factors that concrete encountered in service. The work was therefore broadened to include exposures of many of the specimens to the natural sulfate water of Medicine Lake lying some 20 miles northwest of Watertown, South Dakota. This lake is a 400-acre body of clear water some 30 to 40 ft in extreme depth. The salt content averages around 7 to 8 per cent but ranges from a low of 5 to a high of 12 per cent as it varies with fluctuations of the water level between wet and dry years. About two-thirds of the salts are mag- *(Continued on page 489)*

Farm Structures Designed for the Self-Feeding of Hay and Ensilage

By Charles H. Reed
MEMBER A.S.A.E.

SELF-FEEDING of hay is not new; however, current interest seems to be at an all-time high because of the high cost of labor. Livestock farmers would like to eliminate the second handling of two or more tons of forage for each animal every year.

A common "self-feeder" in the Midwest is the stack. Its use involves much wastage, and occasionally a sow and her pigs or a calf is buried when a stack falls. Fences around stacks help to remedy this disadvantage. Also, it is reported that a few barns in the Southwest will feed up to one-half of their contents. A farmer in the Hudson River valley is experimenting with a self-feeding silo. Following are sources of published information on self-feeding structures:

A semiself-feeding barn is shown on page 15 of Weyerhaeuser's four-square farm building service catalog. The "Country Gentleman" of April, 1947, shows a picture of a practical-looking self-feeding barn in Porter County, Indiana, and in the April, 1948, issue is a picture of a self-feeding structure at Hamlet, Indiana. "Prairie Farmer" of July 31, 1948, describes a self-feeding structure under development by a commercial concern. A silo-type self-feeder for hay is reported in "Progress Report on Drying Hay by Forced Circulation of Air," Special Report No. 34, Tennessee Valley Authority, October, 1947.

The functional requirements for a self-feeding structure for forage are suggested as follows:

1 The structure should be 100 per cent self-feeding, requiring no manual labor.

2 There should be sufficient capacity in the self-feeding structure or structures to store the entire forage crop.

3 Wastage should be negligible, at least not any more than if feeding were done by manual labor in the conventional manner.

This paper was presented at the meeting of the North Atlantic Section of the American Society of Agricultural Engineers at Guelph, Ont., Canada, September, 1948.

CHARLES H. REED is assistant professor of agricultural engineering, Rutgers University, New Brunswick, N. J.

4 There should be no possible hazard to livestock feeding from the structure.

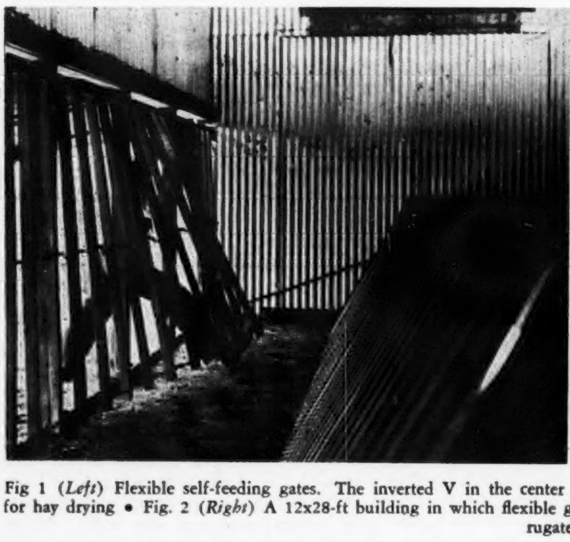
5 The self-feeder should be easy to fill with machinery available to the farmer.

My first experience with a self-feeder for forage was at Purdue University with a portable 12x12-ft structure having a capacity of about 8 tons of chopped hay. It was designed for drying, storing, and self-feeding pasture clippings cut in June to be fed in the pasture during late summer. Disadvantages of this structure were its high cost, difficulty of filling, unreasonable wastage, and instability in strong winds. These disadvantages, together with an accident in which two of the best dairy cows in the herd were killed by lightning while standing near the structure, terminated interest.

At the New Jersey Agricultural Experiment Station there is a project to demonstrate how a hilly northeastern farm can operate on a grassland farming program, with a minimum of labor and imported feeds. The production, storage, and self-feeding of the best possible forage are required. Hereford steers are being fed; however, young dairy stock or dairy cows could be managed in a similar manner, if milk production regulations would permit.

The research on this project had not progressed far before it was apparent that the excessive waste of self-feeding must be eliminated. After about $10,000 was spent for remodeling and installing six different gates, and a fine 1200-pound steer was hanged by the neck (until dead), a flexible self-feeding gate was developed. Feeding trials indicate that it will make possible the functional requirements suggested for a self-feeder. Fig. 1 shows these gates. The inverted V is essential for safe self-feeding, and in this installation serves as the duct for hay drying. Experience indicates that the design of the gates and the proper shape and height of the inverted V have been satisfactorily developed.

The building in which these gates are installed is illustrated in Fig. 2. A summary of the performance of this building with the flexible gates follows: Its entire capacity of 14 tons of chopped hay, averaging 50 per cent moisture, was cured. (Waste heat from a gasoline engine driving the blow-



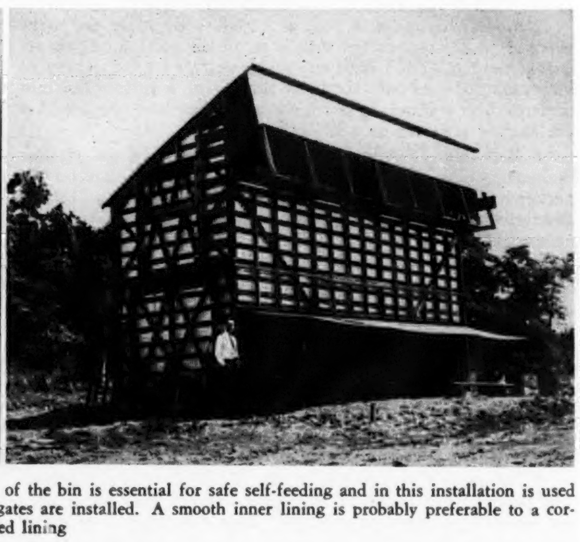


Fig 1 (*Left*) Flexible self-feeding gates. The inverted V in the center of the bin is essential for safe self-feeding and in this installation is used for hay drying • Fig. 2 (*Right*) A 12x28-ft building in which flexible gates are installed. A smooth inner lining is probably preferable to a corrugated lining

er was used.) The contents can be fed without manual labor. Chopped hay, long loose hay, and baled hay have been fed equally well. Baling wire or strings were removed when the bales were placed in the structure.

The last structure built, illustrated in Fig. 3, is 40 feet long and has just been partly filled for the first time. The structure consists of a 20-ft Quonset structure built within a 40-ft Quonset. Both elements are supported on 8-ft columns. The inner structure was intended to serve as a plenum chamber; otherwise hay curing in 10-ft bins would be difficult. We anticipate that this structure will dry 80 tons (dry-weight basis of chopped hay) of high-moisture hay, which will self-feed with no manual labor. Fig. 4 is a cross-sectional diagram of the structure. Our recommendations to the manufacturer are that future structures have 14-ft storage bins and a 12-ft feeding and housing space in the center. The shape of the proposed inner structure is shown by the dotted lines in Fig 4. The upper part of this inner structure would be a plenum chamber and contain adjustable openings to control air flow between the two elements. A plenum chamber in the lower part of the inner structure would not be necessary because an inverted V on each side would serve well for drying hay in a bin 14 ft wide. The acceptance of these recommendations would result in 45 per cent greater capacity and eliminate the inner load-bearing roof, thus reducing storage costs per ton considerably.

Research to be done before this self-feeding project is considered completed is as follows:

1 Install these gates on wider bins. If bins could be 16 or 18 ft wide, lower storage costs per ton would result.

2 Demonstrate the use of these gates in the conventional-type barn by low-cost remodeling.

3 Install gates on a small portable feeder to be used in pastures.

4 Adapt the gates to silo-type storages for feeding either hay or ensilage.

We are grateful to the Stran-Steel Division of the Great Lakes Steel Corporation for its contribution of the Quonset structure, and to Continental Motors Corporation for its cooperation in the hay-drying studies. Most of the financial support for this project has been derived from private and commercial interests. A patent on various features of this development has been applied for by Robert Barnhart, manager, and Paul Mazur, owner, of Fiddler's Creek Farm. However, in the interest of sound development of self-feeding barns, it is felt that experimental use under diverse operating conditions will aid in determining the practical value of the work to date and possibly point the way to desirable improvements. Individual farmers and research and educational institutions may use these developments in return for the right of access to their installations and the use of any data developed by them.

The department of agricultural engineering of the college of agriculture at Rutgers University, New Brunswick, N. J., is the agency through which permission, plans, and specifications of the feeding gates may be obtained; and applications for such permission should be made direct to that institution.

Those of us connected with this project believe that the development and use of satisfactory self-feeding structures in conjunction with modern forage crop management, could revitalize livestock farming in the Northeast.

Fig. 3 An 80-ton self-feeder hay drier under construction, consisting of a 20-ft Quonset inside of a 40-ft Quonset. Both elements are on 8-ft columns

Concrete Draintile for Alkali Soils

(Continued from page 487)

nesium sulfate, one-fourth sodium sulfate, the small remainder being a mixture of various other salts.

The cylinders were stored below the frost line in the lake in wooden crates, 50 cylinders to a crate. Once each year, all cylinders were brought to the shore for examining and photographing, some being removed and shipped to the laboratory for compression tests following exposure for 1, 3, 5, and 10 years. Fig. 5 shows some of the crates after having been brought to the shore. It was customary to extend invitations to the annual inspection and during the years the tests were in progress many engineers and cement chemists were present at one or more inspections.

METHODS OF DETERMINING SULFATE RESISTANCE

The principal physical effect of the action of the soil sulfates on portland cement concrete is an increase of volume caused by chemical interchange.

A close relationship exists between increase in length and loss of compressive strength. By use of an Ames dial apparatus, the expansion of all cylinders exposed to laboratory solutions of $MgSO_4$ and Na_2SO_4 were measured to 0.0001 in between reference pins set in the cylinders when made. It was determined by many tests that increases of 0.01 in in length of 4-in cylinders of the rich mixes used was indicative of losses in compressive strength of 60 to 70 per cent. The durability of concrete exposed to the laboratory solutions was measured by the number of months it required for 4-in cylinders to expand 0.01 in. Some cylinders made in connection with the cement phase of the work, showed failure in laboratory solutions at less than one year, while other cylinders were in good condition after twenty year's exposure.

The resistance of the cylinders submerged in Medicine Lake was determined by strength ratios of 1, 3, 5 years and longer based on compression tests at 1 and 5 years of comparison cylinders stored in tap water in the laboratory.

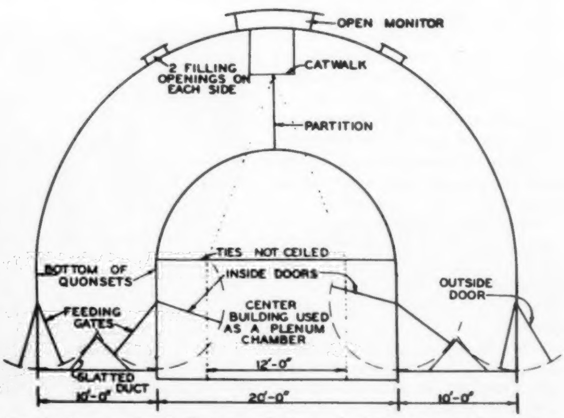


Fig 4 Cross-sectional diagram of 40x40-ft Quonset-type, hay-drying, self-feeding barn. The dotted line is the shape suggested for the inner structure or any future self-feeders of the Quonset type

The Use of Snow Survey Data for Agricultural Planning

By W. T. Frost and R. A. Work

MAN'S endless search for security and personal wealth has led him to the ends of the earth, but his routes of travel and his settlements have largely been determined by the availability of adequate water supplies. In the early days of settlement of the West, the pioneers were able to find plenty of water for all purposes, or, lacking water, they would move on to new lands with unappropriated water supplies.

Today the picture is entirely different. No longer is it possible to "move on" to new lands with available water supplies. Water appropriation has proceeded nearly to a point where all the easily available water has been taken up. There still is plenty of usable land, but the water that is available can be placed on that land only at great expense, an expense that precludes the development of the land by the average individual.

As we approach the point of complete utilization of water supplies in our western areas, the need for a program of efficient water management is being more fully recognized. Such a program is one which considers all the demands on the limited water supply and then allots water in the most efficient manner.

Watermasters, irrigation district managers, reservoir operators and many others in the West, have come to rely on a new tool in water supply management. It is a tool that enables measurement in advance of seasonal water supply; to determine in advance how large a check may be drawn on the bank account, that is, how much water can be drawn from reservoirs or will come from watersheds. This new tool is the snow survey.

More than 75 per cent of the irrigation water supply of the eleven western states originates as snow on mountain watersheds. This snow melts slowly during the early summer months and runs off directly onto the land, or into storage reservoirs where it is held for late season use. This "delayed precipitation" thus provides water essential for irrigation of our western areas during the dry summer months. The snow survey is the recognized means of determining how much water will run off from these mountain snows.

Snow surveying had its beginning in 1909 when Dr. J. E. Church of the University of Nevada frequently determined the depth and water content of the deep snows on Mt. Rose and the relationship of these data to the changing level of Lake Tahoe. In 1913 scattered snow surveys were being made by private organizations in California and by 1919 a similar start had been made in Wyoming. In 1923, the Washington Water Power Company began snow surveys on the Spokane River. The Utah Agricultural Experiment Station in 1924, under the direction of George D. Clyde, who is now chief of the SCS Division of Irrigation, began a research program to determine the relationship between snow cover runoff and, by 1929, the state engineers of Oregon and California were making regular snow surveys over several networks of snow courses.

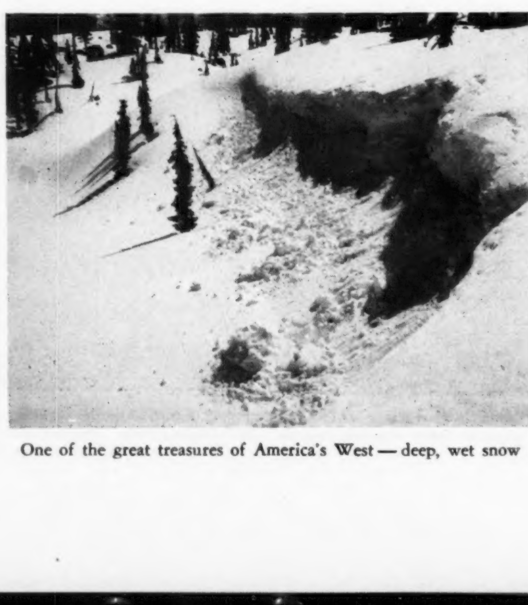
Types of equipment and methods employed in these early snow surveys lacked standardization. Only the immediate needs of the organizations making the surveys were being met. Other water users on the same watersheds were not obtaining the full benefits of the snow surveys being made by their up-river neighbors. Interstate or international exchange and use of these snow survey data was not practical, for no one had as yet assembled all available information in one publication. It was a logical development, therefore, when in 1935 the Division of Irrigation, an engineering research unit of the U. S. Department of Agriculture, was charged by Congress with the responsibility of coordinating and extending the snow survey program. The work in 1939 became a part of the water conservation activities of the Soil Conservation Service.

The program of snow surveys and water supply forecasts based on snow surveys has grown steadily during the last 13 years and has received increasing public recognition of its value among the tools of the water manager. During this past winter, approximately 1000 men from 180 cooperating agencies made 2300 snow surveys on 950 snow courses in twelve states and in British Columbia, Canada. These men traveled about 21,000 miles on skis or snowshoes, or by mechanized oversnow vehicles and took shelter in 185 specially stocked shelter cabins.

Reports of snow surveys and specific seasonal water supply forecasts are prepared for western water users by a corps of nine professional snow survey leaders of the Soil Conservation Service, who make timely release of this information for the following specific areas: Arizona, British Columbia, California, Colorado River Basin, Columbia River Basin, Utah, Montana, Nevada, Oregon, Rio Grande River Basin, and Missouri and Arkansas River Basins.

Both preliminary and final seasonal forecasts are published, the latter being issued as of the first of April. Final revisions of April 1 forecasts are released on May 1. Both the making of snow surveys and the preparations of forecasts for publication require the closest type of cooperation between the Division of Irrigation and the 180 agencies which are affiliated with this program. These cooperating agencies include the Bureau of Reclamation, Forest Service, Geological Survey, Park Service, Indian Service, state engineers and watermasters; state agricultural experiment stations, irrigation districts, power companies, and other federal, state, municipal, and private agencies.

In some areas, the water forecasts are developed and released through a series of local water forecast committee meetings. The meetings are attended by representatives of local irrigation districts, soil conservation districts and power companies, local watermasters, county extension agents, Forest Service and Bureau of Reclamation personnel and others concerned with local water supply problems. Larger meetings are held to develop data and release forecasts on the two basins of the Colorado and Columbia Rivers. These basin meetings are attended also by personnel of the Corps of Engineers of the U. S. Army, the Weather Bureau, hydroelectric power coordinators, industrialists, and others whose activi-



One of the great treasures of America's West — deep, wet snow

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Soil and Water Division.

W. T. FROST is hydraulic engineer, (P. O. Box 1149, Medford, Ore.) and R. A. WORK is senior irrigation engineer, division of irrigation and water conservation, Soil Conservation Service, U. S. Department of Agriculture.

ties and welfare are closely associated with basin-wide water supply problems.

Runoff forecasts of water supply for the western states have also been published in the last three years in western regional journals, which reach members of the profession in the fields of electrical, construction, and reclamation engineering. Radio release of water supply forecasts has always been practiced. Most of these releases have been made a part of the radio stations' regular farm programs, and all have referred to local newspaper releases and to the state or basin mimeographed report.

Let us examine the snow survey and water supply forecasting program a little closer to bring out some basic details. A snow survey consists of a series of samples of the snowpack, usually about ten to twelve, taken at measured intervals of 50 to 100 ft over a permanently marked and mapped course, usually about 1,000 ft long. These samples are taken at the same locations each measuring date, year after year.

The snow sampler consists of hollow duraluminum tubing in lengths of 30 in, with a cutting bit having an inside diameter of 1.485 in. The sampler is forced vertically through the snow until it reaches ground surface. Depth of snow is then read from the graduations on the sampler. The tube is withdrawn from the snow with the core remaining therein and is weighed on an accurate specially made hand scale. This weight minus the empty weight of the sampler gives the weight of the snow, which directly equals the water content of the snow in inches. In computing the completed survey notes, the snow depths and water content for all samples are averaged. These figures are the final data reported from each snow course.

WHY FORECASTING RUNOFF IS A SUCCESS

Successful use of snow surveys in forecasting runoff is due to the fact that most of the snow falling at high elevations occurs in a few major storms which usually are uniform in intensity over large areas. It has been demonstrated that the measurements of accumulated snow at a few locations on a stream's headwaters are directly related to later runoff from the basin. A few snow courses in a large drainage thus provide a dependable index to the winter snow accumulation at high elevations. Snow surveys do not necessarily measure the total volume of water stored in a basin as snow, but measure instead the water accumulated at only a few locations in the basin. The index relationship may be shown by plotting on the axis of ordinates water content of the snow at peak accumulation (usually April 1) and plotting on the axis of abscissas the corresponding resultant runoff. A curve, most often a straight line, may then be fitted to the seasonal plottings and used to forecast the runoff in the following years. The basic correlation between snow and runoff usually requires annual adjustment to compensate for factors which affect that relationship. The most important of these are relative moisture content of watershed soils and ground water conditions as of forecast date. All forecasts must necessarily be based on the assumption that average conditions of temperature and precipitation will prevail during the runoff period.

All water supply forecasts issued by the Division of Irrigation are prepared to meet specific requirements of water users. Most agriculturalists are interested in the total flow to be expected during the six months, April to September, the usual irrigation season. But in some areas where the irrigation season is shorter, as where wild hay lands are spring flooded, forecasts are for a three or four months' period only. In Utah, the forecasts are for April to June and July to September. Forecasts of reservoir inflow are of great importance to both agriculturists and hydropower interests, whereas forecasts of unregulated streamflow concern mostly irrigators.

The uses to which water forecasts based on snow surveys have been put are numerous. Originally conceived to be of greatest aid to irrigators, the forecasts are now being used by hydropower companies, municipalities, and municipal water supply districts; levee, drainage, and flood control districts; navigation companies; mining and lumbering interests; industrial concerns; managers of wild life refuges; engineers and constructors of water-control facilities, and by others concerned with planning or administering water resources.

The value of snow surveys has been ably demonstrated in past years, but it will be interesting to cite some instances of applications of snow survey data to agricultural problems.

The extreme drought conditions that prevailed in the West in 1934 were forecast from snow survey data two to three months ahead of their occurrence. With these forecasts in view, the governor of Utah called the first drought conference ever held in advance of a drought. As a result of the action of this conference, federal and state funds were made available and action taken to alleviate as far in advance as possible the drought conditions in Utah, Idaho, and Nevada.

SNOW SURVEYS GIVE WARNING OF SHORTAGES

In the more recent drought of 1946, in New Mexico and Arizona, snow surveys were used to give advance warning to all water users of expected critical shortages. Concerning this drought, the following statement was made by John H. Bliss, state engineer of New Mexico*:

"The early 1946 season snow forecasts for New Mexico indicated that precipitation and snow cover over the entire state was generally deficient and that, unless late snows improved the situation, runoff in the various stream systems would be well below normal. As the March and April data became available, the dark picture of drought was confirmed.

"As a result of the forecasts, crop acreages were curtailed in most irrigated areas of the state and, to some extent, the longer season crops were reduced or eliminated. It is difficult to evaluate the dollars and cents benefit of the runoff forecasts to the farmers of the state. For one thing, potential damage varied considerably in the various basins.

"The Pecos River basin probably suffered as much as any area of the state because of the drought. The Carlsbad Project, with a very deficient storage supply and poor ground water conditions was severely affected. Mr. T. B. Thomas, acting superintendent of the project, has made the following report on crop conditions: 'The runoff predictions for 1946 were directly responsible for curtailment of acreage planted and resulted in all alfalfa stands suitable for a seed crop being left uncut for a seed harvest. It also resulted in the planting of quick-maturing crops such as small grains, forage crops, etc., which would mature from the limited supply of water available. The value of the matured cereal and hegari crops was $145,900, and the alfalfa seed crop value was $131,900, or a total of $277,800. The cropped acreage was reduced from a probable 25,000 acres to 19,800 acres actually planted.'

"With these data, it is possible to make an estimate of the value of the forecasts to the project. Assuming that monetary loss to the farmers on the above acreage would have been 10 per cent of the value of the crops grown, had the fields been planted to the usual crops, the money saved would have approximated $28,000. The money which might otherwise have been lost, had the uncropped 5,000 acres been prepared and seeded, may have been as high as $20,000. In other words, knowledge of the deficient 1946 runoff of the Pecos may have saved the farmers as much as $3.00 to $3.50 in actual cash outlay for each acre where the usual irrigation practice was altered or stopped entirely. Other benefits not readily evaluated will probably double the above indicated value of the snow forecasting service to the project.

"The value of the service is unquestioned in evaluating the snow cover data and passing that knowledge on to the water consumer, whether it be for good or ill."

The prospective drought situation in Arizona in 1946 was summarized in the following statement by Clyde E. Houston, hydraulic engineer with the Soil Conservation Service*:

"The final Federal-State Cooperative Snow Survey and Irrigation Water Forecast for Arizona, released March 15, 1946, contained the following statement: 'An acute shortage of irrigation water appears imminent throughout the major irrigated areas of Arizona'.

"Taking cognizance of these facts, the Salt River Valley Water Users Association immediately decreased their expected deliveries from 3.5 to 3.0 acre-feet per acre. The monetary value of an early forecast is difficult to determine in this case, but it gave the Association time to spread the available supply of water so that it would result in the least amount of damage to crops, especially the citrus orchards.

"On the San Carlos Irrigation and Drainage District of the Gila River, the management allotted water at the rate of one acre to be served with water for every three acres of water right. This meant an irrigated acreage of 30,000 acres instead of 100,000. The fore-

*Snow Surveyor's Forum for 1948, pages 36 to 48.

cast was upheld by useable storage in the reservoir becoming zero during the period June 24 to July 19, the first time useable storage has reached zero in 17 years of existence of the reservoir. Recorded inflow into the reservoir was approximately equal to the lowest year of record since 1895. Exact estimates of money saved to farmers by discouragement of 1946 planting of about 60,000 acres in this project is not yet available, but savings of seed and labor were unquestionably large."

The Pathfinder Reservoir on the North Platte watershed in Colorado serves some 450,000 acres of irrigable land. Former regional director E. B. Debler of the U. S. Bureau of Reclamation at Denver, Colorado, in commenting on the operation of this reservoir, said*:

"The winter of 1939-40 was an open one and the first snow survey report, which was available about February 10, indicated that the snowfall in the North Platte watershed was light. This information was publicized in the newspapers with a warning that, unless conditions greatly improved, a major shortage could be expected. Following the report of April 1, which confirmed the earlier report, circular letters were issued by some of the larger districts, advising of the anticipated runoff conditions and suggesting that water users plan their cropping program accordingly. The Bureau of Reclamation informed the districts, having interests in the storage system, that the estimated water supply would probably enable delivery of 0.50 acre-feet per acre to the land. This information was transmitted to the water users and the individual farmers adjusted their cropping program to best fit the available water supply. This early forecast and warning enabled the farmers to determine how many acres of beets, potatoes, new alfalfa seeding, or small grains they would plant, thereby saving many thousands of dollars worth of seed, in addition to being able to select crops best adapted to specific farms considering the available water supply. The final figure on water deliveries to the land, on the North Platte Project that season, was about 0.55 acre-feet per acre."

Utah also experienced drought conditions in 1946 and Mr. D. K. Fuhriman, irrigation engineer of the Soil Conservation Service has this to say about the use of snow survey data*:

"During 1946, in the southern part of Utah, snow surveys indicated that streamflow on the Sevier and Virgin Rivers would be considerably below normal.

"The predicted drought conditions in southern Utah materialized as the season progressed. However, on the Sevier River, the holdover storage in reservoirs having a total capacity of over 400,000 acre-feet was excellent; and as a result, by applying ordinary conservation practices in many areas, normal crop maturity was realized. Advance knowledge of the dearth of water supplies allowed the irrigation officials to regulate the reservoirs wisely and to distribute the available water in a beneficial manner for all users. Crops were matured on most of the 230,000 acres of irrigated land under this river system, despite a water supply of only 25 to 40 per cent of average for different areas along the river."

Mr. Fuhriman goes on to say, in an unpublished manuscript:

"In Utah, we forecast water supplies during the April to September and the July to September periods. The former is to obtain an indication of total available supply, including the high spring runoff; and the latter to make information available to primary users who have no supplemental storage water available. Many water users have found this service valuable. Among them are the agriculturists engaged in sugar beet production. Sugar beets cannot mature properly if there is an inadequate water supply available to them during the late summer. It is during this period that the success of the crop hinges directly upon the water supply. Utah is an important producer of sugar beets and of course sugar has been a critical crop for several years. In 1946, the Utah-Idaho Sugar Company recognized the probability of a water shortage in some areas of the state, and withheld contracts for sugar beet production until information was available on prospects of late-season water supplies. This knowledge dictated in what areas sugar beets could be grown with reasonable assurance of proper maturing of the crops planted."

Although forecasts of drought conditions have proved to be of great assistance to irrigators, the snow survey forecaster has a heavy responsibility in the years when he predicts abundant water supplies.

For instance, in Deschutes County, Ore., the snow surveys of April, 1946, indicated that water supply in prospect would greatly exceed the average and in some cases would produce new records of maximum flow. As a result of this forecast, approximately 2,500 acres of land were seeded and irrigated, which otherwise would not have been planted if an abundant water supply had not been forecast. This cultivation of additional acreage helped to produce a near record crop. The cash value of crops (potatoes, grain, hay, and pasture) from this additional land was estimated at $250,000 by the county agent.

Similarly, in Crook County, Ore., . . . 4000 acres which normally are not seeded, due to lack of water, were seeded and irrigated. The county agent estimated the value of crops raised from these 4,000 acres at approximately $400,000.

Thus the 1946 water supply forecasts in Oregon made possible the production of extra farm crops in these two counties, with a total value of approximately $650,000 to the farmer.

Not many people realize that approximately 50 per cent of the total flow of the Columbia River at The Dalles has its source in the mountains of British Columbia. Snow surveys there began about 14 years ago and the networks of courses in our two countries have been closely integrated from the beginning.

One of the international problems which snow surveys are helping to solve is the regulation of Kootenay Lake in British Columbia. This lake provides water to operate generators of the West Kootenay Power and Light Company, and in years of low runoff, maximum storage must be maintained to provide operation at full capacity. However, in years of high runoff, the lake level needs to be reduced to provide space for flood flows which cause a backwater endangering an extensive area of diked farm lands lying between Bonners Ferry, Ida., and Kootenay Lake, B. C.

In 1946, the snow surveys indicated that a high runoff could be expected in the Kootenay drainage and on March 10, warning of expected flood conditions was issued. As a result of the warning, dikes were strengthened and other preparations made to deal with impending flood waters. The Kootenai Valley Reclamation Association at an early date sought the help of the Corps of Engineers, U. S. Army, to hold the system of dikes that confine the river. On the basis of high runoff forecasts, Kootenay Lake was drawn down to below its natural level to cushion the effect of the flood peak on the reclaimed lands. The Corps of Engineers furnished promised assistance which undoubtedly saved some of the agricultural lands from being inundated. Major R. C. Farrow, comptroller of water rights *(Continued on page (494)*

Left: A snow surveyor driving the snow-measuring tube with a driving wrench. One-inch intervals are plainly marked on the side of the tube • *Center:* Measuring the length of the core as seen through the slot in the snow-sampling tube • *Right:* Getting the weight of the snow sample. Note the use of the ski pole to steady the scale during the weighing process

Agricultural Engineering in the Northeast

By Harry E. Besley
MEMBER A.S.A.E.

AGRICULTURAL Engineering is becoming a more dynamic force in northeastern agriculture. In this region of the United States, there is a general awakening to the potentialities of an engineered agriculture. In fact, it may be more than an awakening. It may even be a metamorphosis. Where once there was one overworked agricultural engineer with an agency, business, or institution, who was the "fix-it guy", there are now several agricultural engineers who are concerned with design, improvement, and application. They are still overworked because too few engineers have been trained to meet the demand. But a new day is dawning and I believe the polliwog is about to jump.

Several factors have contributed to the unprecedented demand for engineering know-how and service in agriculture. The two that head the list are returned war veterans and the shortage of farm labor. There has been a great influx of the former into our colleges and onto our farms. These men have successfully fought a machine-age war and are now determined to apply the advantages of mechanization to their job of farming. In colleges our resident teaching staffs have had to expand to meet the increased demand for classes in shop, farm machinery, rural electrification, and other subjects. Generally there are still too few taking work toward professional agricultural engineering degrees, but as courses leading to the degree are increased and expanded, it is expected that the need for trained men can be met.

On the farms the demand is for assistance from the extension agricultural engineer to advise on mechanizing operations and on developing new techniques, machines, or structures to reduce labor, improve a product for market, or spread the marketing season. Shortage and high cost of farm labor have forced farmers to use mechanical equipment. In many areas of the Northeast mechanization was considered impractical because of farm layout and terrain. The farm equipment industry has developed power machinery for use on small acreages of rugged terrain. Farmers are prepared to use the machinery, so the problem is one of supply and not one of selling. Also coming in for its share of attention is rural electrification. The entire Northeast is almost 100 per cent electrified, but utilization of this servant has lagged. Farmers have not appreciated the advantages to be gained by full use of electric service. However, that situation is rapidly changing.

Many problems of design have been uncovered by extension engineers. It is here that the research engineer comes into his own, and I am genuinely enthused about the prospects for research in agricultural engineering in the Northeast. Two events in the past two years have done much to develop a research consciousness, particularly in farm buildings. One was the establishment of the Rutgers University Farm Buildings Institute in 1944: the second is the Flannagan-Hope Act. The former, established under a grant from the John B. Pierce Foundation, was created to make "a systematic and thorough study of farm buildings' design with a view to establishing, on a national basis, minimal and optimal standards for agricultural buildings." Despite the national scope of the Institute, much of its work has been centered in the Northeast. While it is not in itself a research organization, one function has been to point out needed research in farm structures. The scope of its work was limited to consideration of structures allied to the poultry, animal, and dairy industries. The report of the subcommittee considering poultry house requirements has been released as New Jersey Agricultural Experiment Station Bulletin 732. The other committee reports are in process and will be available as soon as some printing bottlenecks can be broken.

It is possible that the need for research, as advocated by the Institute, has only recently reached the inner sanctum on the administrative level, as the work of the various committees was performed at the professional level and it is the professional workers who are most interested in its findings. However, research in farm structures along with other agricultural research has been stimulated at top side by the Flannagan-Hope Act (PL 733). Its implications have reverberated through the administrative chambers for nearly two years now. One of the most serious revelations, uncovered during the formative stage of projects under this act, was the small number of people actively engaged in agricultural engineering research. While this is particularly true in the Northeast, the same condition probably exists in other regions but to a somewhat lesser degree.

When the first northeastern regional conference on farm structures and rural housing was called to prepare and submit research projects in accordance with the provisions of the Flannagan-Hope Act, only 8 of the 12 states in the region could scare up a qualified representative to send. Incidentally, the states included in the region are Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Delaware, Pennsylvania, West Virginia, and Maryland. Of the 19 representatives from the 12 state colleges, only 11 had any research assignment, and, of the 11, 5 were engaged in research on a very limited scale only. This is not a very glowing picture to paint, but it certainly indicates the need to change our own thinking or that of our experiment station directors about agricultural engineering research.

There is tangible evidence that this personnel situation on the research side is being corrected. In response to a questionnaire sent to agricultural engineers in all 12 land-grant colleges in the Northeast, it was reported that we now have the equivalent of 17 full-time men working on agricultural engineering research. Provision is made for some research in agricultural engineering in all but two of the colleges. One of the major research interests at present is forage handling, including hay harvesting and curing. Other items near the top of the research list are the development of labor-saving techniques and machinery, and the design of equipment for weed and insect control.

The extension engineers report emphasis along similar lines, which is to be expected, and add farm structures and rural electrification to the currently active group of major interests. In the rural electrification field, adequate wiring is receiving particular attention. The extension men also report that they spend a lot of time helping farmers adapt machinery and equipment to special needs in the region. This is not according to Hoyle; the job should be done by the industries manufacturing and marketing the equipment. On this premise, there should be excellent job opportunities in private industry for our agricultural engineering graduates.

Reference was made to a questionnaire in which the major research and extension activities were reported. The return on that questionnaire in itself is evidence that the northeastern group is on the alert. The response was 100 per cent.

A few statistics taken from the questionnaire may be of interest. There is a separate agricultural engineering department in all except two state colleges of the Northeast. In Maine the department is combined with agronomy, and in Delaware there is no department.

There is at least one agricultural engineer in each land-grant college. The number varies from 1 to 17; the total is 75. Thirty-seven are engaged in teaching, 21 in extension, and 17 in research. These are all equivalent figures since many of the men are engaged in more than one activity.

An address before a meeting of the North Atlantic Section of the American Society of Agricultural Engineers, at Guelph, Ontario, Canada, September, 1948.

HARRY E. BESLEY is chairman of the agricultural engineering department, Rutgers University, New Brunswick, N. J.

Most of the students taking agricultural engineering courses are majoring in some other field. It is reported that over 1300 are taking our service courses. About 500 more are enrolled in short courses. Only about 125 are listed as majoring in agricultural engineering, but there are slightly over 200 enrolled in professional agricultural engineering curriculums. About one-half of the latter are at Pennsylvania State College.

The professional curriculum situation varies as widely in the Northeast as in most other regions. Most departments are individually giving this matter considerable attention, but no regional coordination exists. The situation at present is about like this:

1 Pennsylvania State College offers a curriculum leading to a B.S.A.E. degree in four years, from the college of agriculture.

2 Maine, Maryland, and Rutgers (New Jersey) offer a B.S.A. degree, with a major in agricultural engineering in four years. In one additional year, a student can obtain a B.S. degree in civil, electrical, or mechanical engineering from the college of engineering or technology.

3 Massachusetts offers a curriculum leading to a B.S.A.E. degree in four years, from the college of engineering.

4 New Hampshire, Vermont, and West Virginia now offer, or will offer in the near future, a curriculum leading to a B.S.A.E. degree in four years, with joint administration by the colleges of agriculture and engineering.

This gives us a professional curriculum in two-thirds of our land-grant colleges in the region.

In setting up the professional program most departments are confronted with the problems of offering suitable agricultural engineering courses and of properly balancing the curriculum.

Organizing courses in a small department poses a difficult situation. Frequently there are insufficient staff and/or students to set up separate courses for the professional engineers, and they must take their farm machinery, farm structures, and similar subjects with the regular agricultural students in a service course. This is generally unsatisfactory because the interests and aptitudes of these two groups are widely different. One is interested essentially in design and development and the other in operation and maintenance. One solution is to give the engineer special assignments, but that certainly does not create goodwill among the students.

It has been stated in various ways and on many occasions that the agricultural engineer must bridge the gap between biology and engineering. The most recent comment on this point that I have read is in a paper by Ray W. Carpenter which appeared in AGRICULTURAL ENGINEERING for June, 1948. It provides interesting and provocative reading.

If the agricultural engineer is to bridge the gap between biology and engineering and also give forth on engineering know-how, then he must be trained as an engineer. He should also be familiar with the work of the biologist. How can all of this be built into a balanced curriculum covering a reasonable period of time? The answer to this question is deserving of the continued attention of the best brains in the ASAE.

Based on rather unhappy personal experience, I am strongly opposed to any compromise on the courses in engineering fundamentals for those men who desire an engineering degree and who expect to be practicing agricultural engineers. To crowd agricultural and agricultural engineering subjects into an already full four-year engineering program is a tough job. I feel that, until more of the courses in agriculture and engineering are designed especially to meet the needs of agricultural engineers, too many compromises must be made in the present engineering program to complete the job effectively in four years. At Rutgers we adhere for the present to the "five-year plan". This penalizes the student in so far as time is concerned, but I feel the end product justifies the severe treatment.

Practically all institutions offering five-year programs grant two degrees. A B.S.A. degree with a maior in agricultural engineering is granted after four years. A B.S. degree in engineering is granted for successful completion of the fifth year's work. The student, at the end of four years, has completed the required work in agriculture and is fairly well grounded in engineering fundamentals, but has not received many of the required engineering courses in application and design. Unfortunately in the professional field, this man with a B.S.A. degree is neither fish nor fowl, neither engineer nor agricultural scientist. Something should be done to make him a legitimate offspring. It is recommended that a committee from this Section be designated to work with the College Division of ASAE in an attempt to solve these two problems of course and curriculum content.

Use of Snow Survey Data

(*Continued from page 492*)

in British Columbia, was commenting on this situation when he said:* "It has been estimated that had the threatened dikes in Idaho given way, loss and damage would have totalled some four million dollars. On the same basis of calculation, the damage in the Kootenay Valley in Canada would have run to about three million dollars."

Diked lands along the lower Columbia River, as at Sauvies Island, for instance, also benefit by early statements of probable runoff.

All of us know of the recent disastrous and very damaging flood of the Columbia River. The situation was foreseen in advance of the flood, as evidenced by the May 1 Snow Survey report for Columbia River Basin, which stated in part as follows: "The outlook a month ago in these areas (northern and western parts of Columbia River Basin) for greater than normal runoff with possible flood hazard has changed to certainty of runoff of flood proportions with attendant damage in vulnerable areas."

Another recent use of snow surveys, with an indirect but important effect upon agricultural practices, was made in connection with the recent "brownout" in California and Nevada. It will be recalled that winter precipitation and mountain snowfall in these areas was greatly deficient until March and April, when abnormally heavy storms improved the situation considerably on the California side of the Sierra. It was good news to water users to read in the newspapers on April 13: "Snow surveys now show that the mountain snow cover had increased sufficiently so that a temporary lifting of the 'brownout' restriction is possible." The removal of this restriction was very important to many irrigators who desperately needed power to pump water onto their lands.

In summary, we have seen some of the ways in which snow surveys have been used as a tool to aid agriculture. In years of short water supply, as forecast from snow surveys, the acreage of land irrigated may be reduced; forage crops may be substituted for row crops; early maturing crops or those with low water consumption may be substituted for crops such as beets or potatoes which require large amounts of water and late irrigation. In orchards, the fruits may be thinned out and cover crops disked under early in the season; advance knowledge of short water supplies allows time to develop other supplies and to improve canals and laterals to decrease losses; maximum use may be made of spring flood water and all water users may be warned to cooperate in a concerted effort to reduce water waste.

In years of heavy mountain snow cover and abundant water supplies, additional acreages may be irrigated and plans changed to grow crops which have a high water consumption requirement. Owners of diked lands can prepare in advance for expected high water which will test the strength of their protective works. Managers of reservoired water supplies can provide early withdrawals with assurance of later inflow, thus protecting their own works and the property of individuals both up and down stream.

The use of snow survey data in agricultural planning has grown tremendously since the first forecast was made for Lake Tahoe in 1913. Today's intensive utilization of water supplies together with the growth of multiple-purpose activities in terms of basin-wide developments, will lead to more widespread and intensive utilization of snow surveys.

"What Is Professional Recognition?"

ARE YOU a professional agricultural engineer or a technician? Following are excerpts from an article by N. W. Dougherty, dean of engineering, University of Tennessee, titled "What Is Professional Recognition"* which should be read by every member of the American Society of Agricultural Engineers:

"Professional recognition may mean many things from certification by an official, or a self-appointed body, to general acclaim by the public at large. To be real and lasting, it must be deserved because of professional achievement, and such achievement must be acceptable to both the profession and the general public. Only trained professionals can distinguish between good and excellent achievement, and consequently formal recognition must be by the profession itself. Fortunately the public will take professionals at their own estimate of themselves; consequently public acclaim becomes a reflection of the professional attitude of individuals toward themselves and their work.

"Because of their background of design and construction, engineers are apt to think of recognition as something that they can design and build rather than as something that grows over a long period of time. They can, by taking thought, improve the climate or the conditions of growth, but they cannot force recognition by merely increasing the shifts and shouting a little louder. Its growth is more like the tree of the forest than the quick responding plant of the greenhouse. Underbrush may be cleared and the branches may be trimmed, but the growth must be the result of good atmosphere, good climate, and favorable conditions.

"What do we mean when we talk about professional growth? There are certain qualities or characteristics which are peculiar to members of a profession, and the process of acquiring these qualities may be considered as professional growth for individuals. Obviously they must be first acquired by the individuals before they can become characteristic of a group.

"Engineers individually can start recognition by personally adopting a plan of activity which will develop their own aptitudes and will show forth to the public that they are professional.

"In 1946, the Committee on Professional Recognition of ECPD made a composite of many statements showing the attributes of a profession and its practitioners, as follows:

ATTRIBUTES OF A PROFESSION

"1 It must satisfy an indispensable and beneficial social need.

"2 Its work must require the exercise of discretion and judgment and not be subject to standardization.

"3 It is a type of activity conducted upon a high intellectual plane.

"(a) Its knowledge and skills are not common possessions of the general public; they are the results of tested research and experience and are acquired through a special discipline of education and practice.

"(b) Engineering requires a body of distinctive knowledge (science) and art (skill).

"4 It must have group consciousness for the promotion of technical knowledge and professional ideals, and for rendering social services.

"5 It should have legal status and must require well-formulated standards of admission.

ATTRIBUTES OF PROFESSIONAL PRACTITIONERS

"1 They must have a service motive, sharing their advances in knowledge, guarding their professional integrity and ideals, and tendering gratuitous public service in addition to that engaged by clients.

"2 They must recognize their obligations to society and to other practitioners by living up to established and accepted codes of conduct.

"3 They must assume relations of confidence and accept individual responsibility.

"4 They should be members of professional groups, and they should carry their part of the responsibility of advancing professional knowledge, ideals, and practice."

"If engineers perform their obligations to society, they should expect society to recognize them as they are. To get public respect and public esteem, the engineer must not only do his job well, but he must see to it that the general public understands the difference between a technician and a professional practitioner. Too often the title has been loosely applied to various skilled trades, thus confusing the concept in the public mind. The engineman, or engine operator, has been popularly called an engineer for many years; others of the skilled trades have assumed the title.

"To get the public respect that engineering deserves, engineers must tell about their more complicated works in a language that the public can understand. Behind the technician there is a man who is doing mental work rather than exercising manual skill. His task should be shorn of its mystery and brought out into the open for general understanding. Popular writings on science and technology can be made to serve a very useful purpose in this age of power and machinery.

"At the first annual meeting of ECPD a 'minimum definition' of an engineer was written, as follows:

"Graduation from an approved course in engineering of four or more years in an approved school or college; and a specific record of an additional four years or more of satisfactory practice.

"Then was added the possible equivalent of a combination of study and practice which would simulate the above. It was hoped that this would be the requirement for membership in a society, for civil service recognition of professional grade and for beginning practice as certified by engineering registration. Probably the most universal form of certification today is state licensing or registration. Some 92,000 engineers have been certified in this way.

"At least one more step must be taken, and its urgency is becoming apparent as the years slip by. Under the Wagner Act all employees not earmarked as an arm of management may form collective bargaining units. Because of the intense activity of the trade unions, the impact of a collective economy will be felt by engineering professionals of all grades. Certainly we must define professional and confidential and we must be able to distinguish beginning professionals from the accepted non-professionals. Some work has already been done, but we are still in the early stages of a solution to this vexing problem.

"If the engineer must give up his individuality in his search for economic security, he must conform to group classifications. Already job analysis and job classification are spreading over into the professional fields, and this carried to its final conclusion will mean something comparable to jurisdictional activities in the trades.

"The movement to get unity and professional recognition is more than forty years old. Much has been accomplished, but so much remains to be done that we are in danger of being appalled at the magnitude of the task. To get the answer we must think upon these things and search for methods which will give us desirable solutions. The signposts have been set, the direction of movement is becoming apparent, our task will be to get into the movement personally and as groups."

This is the first of a series of four editorials sponsored by the ASAE Committee on Professional Registration. — S. M. Henderson (chairman) and R. K. Frevert.

*Published in The Registration Bulletin for June, 1947, of the National Council of State Boards of Engineering Examiners.

RESEARCH NOTES

A.S.A.E. members and friends are invited to supply, for publication under this heading, brief news notes and reports on research activities of special agricultural engineering interest, whether of federal or state agencies or of manufacturing and service organizations. This may include announcements of new projects, concise progress reports giving new and timely data, etc. Address: Editor, AGRICULTURAL ENGINEERING, St. Joseph, Mich.

USDA Notes on Heat Pump, Fertilizer Application, Commercial Processing, Farm Refrigeration, Corn Drying, Weed Control on Ranges

New Heat Pump Project. The Farm Electrification Division of the Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA, has joined the Kansas agricultural and engineering experiment stations in a cooperative research project on the heat pump. Preliminary investigations of the reverse-cycle refrigeration principle have been sponsored in the state by the Kansas Committee on the Relation of Electricity to Agriculture, which also is actively interested in the new project. Warren C. Trent, appointed in September to the USDA Farm Electrification Division, will devote full time to the heat pump work, with headquarters in the agricultural engineering department of Kansas State College at Manhattan. A graduate of Oklahoma A. & M. College, where he taught mechanical engineering for a year following his service in the Navy, Trent received the MS degree in mechanical engineering from Purdue in August, 1948. His thesis was on heat transfer problems in heat pump development.

Tentative plans for the research work are to investigate problems connected with use of the ground as a source of heat and as a heat sink. Attempts will be made to determine the actual transfer coefficients for different types of soil under various moisture conditions.

Fertilizer Application Problems. At the annual meeting of the National Joint Committee on Fertilizer Application held in Cincinnati, September 8, a number of the points made were of particular interest from the agricultural engineering standpoint. Equipment for fertilizer application was discussed in some detail by R. M. Merrill of Deere and Company.

Fertilizer placement studies are being carried on at agricultural experiment stations throughout the country, and each year the volume of data available increases. Each year also, however, the magnitude of the fertilizer placement problem increases and new developments in agricultural science and technology as well as changing farming practices emphasize needs for new work.

One of the functions of the National Joint Committee is to assemble and present for the guidance of equipment manufacturers the findings of research workers on effective application for maximum benefits from fertilizer. The booklet, "Methods of Applying Fertilizers," issued in April, 1938, by the Committee, contains the basic set of recommendations used by the industry in developing new machinery. A revision is planned for the near future. Mr. Merrill urged that in addition, attempts be made to interpret the results of the extensive experimentation carried on each year by the National Joint Committee and put them into some type of summary for general use.

Referring to a report made at the 1946 annual meeting by C. H. Zirckel, Mr. Merrill noted that, in the more than 20 years of the National Joint Committee's existence the equipment industry has succeeded fairly well in providing equipment to apply fertilizers in the manner indicated by the available recommendations.

"Many technical agricultural workers and farmers," said Mr. Merrill, "are somewhat dismayed at the apparent slowness of development of equipment for applying fertilizer in the way these individuals think gives superior results. However, to anyone familiar with the difficulties encountered and the time required to develop a piece of equipment suitable for relatively wide areas consisting of many different soil and field conditions, the delay is not surprising. The equipment manufacturer must have some assurance of acceptance of the equipment before major changes from previously acceptable designs are made. The use of fertilizers and their application has been such a controversial matter that it is very difficult for the manufacturer to determine what practices will be most effective or generally adopted."

Mr. Merrill reviewed progress in developing placement machinery for fertilizing various crops. As to corn, for example, he pointed that for many years corn planters have been supplied with the split-row or two-band distributor. This was developed before depth of fertilizer in relation to the seed was considered important. Placing fertilizer below the seed in bands on each side of the row presents an engineering problem. There now seem to be indications that fertilizer on one side of the row may be satisfactory. If this proves to be true the task of deeper placement of fertilizer for corn at time of planting will be greatly simplified. In many cases the depth of seedbed is the limiting factor. Placement of fertilizer in hard ground below the prepared bed necessitates more rigid construction than is used in the conventional planter.

Community Processing. The farm and community processing work under W. M. Hurst in the Division of Mechanical Processing of Farm Products (USDA) now has William M. Bruce stationed at Athens, Ga., as associate agricultural engineer. A graduate of Virginia Polytechnic Institute, Bruce had ten years' experience with the Soil Conservation Service.

This past summer's project in cooperation with the University of Georgia has involved testing and development of machinery for small-scale processing of fruits and vegetables in community canneries and freezer-locker plants. Experimental and commercial machines were tested and demonstrated at various points throughout the state. One of these was a sheller designed for dry beans and peas which the engineers adapted to green beans and peas for freezing and canning. It can handle 300 or 400 lb per hr, whereas a worker can shell by hand only about 10 lb per hr. A blancher developed by the University of Georgia was further improved, and a commercial green bean cutter was also tested.

This fall work will be started in testing and developing equipment for processing poultry and meat at locker plants.

Grain Storage Staff Increased. Two new appointees to the USDA Division of Farm Buildings and Rural Housing assigned to grain storage investigations under the Research and Marketing Act are Philip B. Doherty and Fred R. Aldred. Doherty graduated in agricultural engineering from Iowa State College in June and is stationed at Ames, where W. V. Hukill is in charge of all small grain and corn starage work. Aldred is assisting Harold A. Kramer on the rice drying project at Beaumont, Texas. He has a BS in agricultural engineering from the University of Georgia.

Other Research Appointments. Russell B. Stone has been appointed junior agricultural engineer in the Division of Farm Electrification. He is assisting Dr. O. A. Brown with the tobacco-curing studies at Oxford, N. C. Stone has BS degrees in both electrical engineering and agriculture from the University of Arkansas.

George F. Sainsbury has joined the Division of Farm Buildings and Rural Housing at its station in Wenatchee, Wash., where he will devote his time to apple storage investigations. Sainsbury has been in refrigeration work with the York Corp. at Seattle. His degree in mechanical engineering is from the University of Washington.

Farm Refrigeration. In cooperation with the Housing and Household Equipment Division, Bureau of Human Nutrition and Home Economics (USDA), and the Texas and Washington agricultural experiment stations, the USDA Farm Electrification Division is launching a study of existing farm refrigeration facilities. Dr. Earl McCracken of the BHNHE and agricultural engineer Harry L. Garver have prepared a detailed schedule which they are taking to about 150 farms. Their principal interest is in the homemade walk-in-type freezer locker.

New Cotton Ginning Laboratory. Work has begun on construction of the $190,000 Southwest Branch U. S. Cotton Ginning Laboratory at Mesilla Park, New Mexico, on the campus of the New Mexico College of Agriculture. A five-acre tract was donated to the United States for the laboratory by the State of New Mexico. The building will be equipped for studies by the Division of Mechanical Processing of Farm Products and the Cotton Branch of the Production and Marketing Administration on fiber production problems peculiar to the irrigated cotton areas of the Southwest.

Plan Exchanges. Burke L. O'Neil has joined the staff of the USDA Division of Farm Buildings and Rural Housing as an associate architect under J. Robert Dodge, in charge of the Plan Exchange Service. Work on the Northeast Plan Exchange is nearing completion and extensive revision of the Southern Plan Exchange has beguh.

Farm Machinery Mission. Roy B. Gray, chief of the USDA Farm Machinery Division, is serving as a member of the Farm Machinery Mission sent to the European recovery program countries by the Food and Agriculture Division of the Economic Cooperation Administration.

Corn-Drying Information. Claude K. Shedd of the Division of Farm Buildings and Rural Housing, USDA, has prepared a multilithed publication summarizing the information obtained from the 1947-48 cooperative studies of mechanical drying of ear corn in cribs on corn belt farms. Issued as Information Series No. 89, of the Divisions of Agricultural Engineering, "Mechanical Drying of Corn on the Farm," it attempts to make available for immediate use by farmers the best practical advice which the engineers can give based on their findings.

Cooperating in preparation of the recommendations were the Grain Branch of the Production and Marketing Administration, USDA Extension Service, and the agricultural experiment stations of Iowa, Illinois, Indiana, Ohio, and Michigan. Among the points discussed in the publication are filling and preparation of cribs for mechanical drying, recommendations for unheated air, drying tests with heated air, and general specifications for a portable heated air drier. There is also a limited discussion of problems connected with drying shelled corn.

Manufacturers of drying equipment who participated in the cooperative testing program received a tech- *(Continued on page 498)*

Research Notes

(*Continued from page 496*)

nical report of results prepared by C. K. Shedd and L. E. Holman of USDA and A. W. Cooper of Purdue.

Range Research. On October 9, some 3,000 visitors attended the annual field day at the USDA Southern Great Plains Experiment Station near Woodward, Okla. The enthusiastic crowd included farmers and ranchers from Texas, Kansas, Colorado, and New Mexico, as well as Oklahoma. Station superintendent D. A. Savage and his associates reported their findings from pioneering research, including the field of weed and brush control on pasture and range land. Experiments have been carried on for 7 years and are continuing. New data are obtained annually on additional phases of range operations and management.

Since 1946 the station has done extensive work on chemicals for control of range brush and weeds. One proper application of 2,4-D has been found to be more effective, cheaper, and easier than mowing. The new weed killer has little harmful effect on range grasses and does not injure any class of livestock.

A single pound of 2,4-D per acre in 5 gal of solution, including a gallon of No. 2 or lighter diesel oil per acre emulsified in the solution to increase its effectiveness, has given complete eradication of 80 per cent of the sagebrush plants and highly effective control of the rest, with some of the weak regrowth dying during the following summer. Higher rates of application proved no more effective.

It will interest engineers to know that the station finds airplane application more effective than application with ground machines. Plane equipment needed for an efficient job includes a boom extending the width of the plane, effective nozzles, return-flow agitator, wind-driven pump, pressure gage, and tank and nozzle cut-off valves. The 2,4-D solution is applied at flight spacings not exceeding 1½ times the boom width.

The experiments have shown that skunkbrush responds to 2,4-D about the same as sagebrush, while sandplum is more resistant. Although shinnery oak can be defoliated and much of the top growth killed, none of the plants have been eradicated in the tests conducted so far.

According to information gathered by the Southern Great Plains station, more than 100,000 acres of sagebrush range was treated by airplane spraying companies in 1948 at a total cost of $2.00 an acre, exclusive of flagmen, and some additional acreage has been sprayed by ground equipment at the same cost.

Mowing of sagebrush and mechanical destruction of the plants with power-driven flail machines are also effective pasture and range improvement practices. On a yearlong basis, mowing of sagebrush at the Woodward station has resulted in advantges of 80 per cent in carrying capacity, 4 per cent in gain per head, and 76 per cent in gain per acre. Summer-grazed mowed pastures have yielded a 45 per cent greater carrying capacity, 14 per cent more gain per head, and 78 per cent more gain per acre than unmowed pastures.

Agricultural Engineering in the Philippines

TO THE EDITOR:

I HAVE just been appointed head of the agricultural engineering division, Bureau of Plant Industry, Philippines Department of Agriculture and Natural Resources. More recently I have been trying (1) to introduce small farm machinery to our farmers to compensate for the acute shortage of working animals and (2) to open up large tracts of virgin land on the Island of Mindanao to mechanized farming. The former project was a failure because the small walking tractors with rotary tillers, after exhaustive tests in our paddy rice fields, proved to be very unsatisfactory, for the reason that they do not develop sufficient traction to make the tillage operation proceed smoothly. I believe, however, we can modify the design so as to substitute track layers for the rubber-tired wheels.

The second project mentioned above was moderately successful, and I am now working, in a private capacity, with a group of agriculturalists to help hundreds of small farmers in our densely populated region to migrate to Mindanao and start mechanized farming there collectively.

At the present time the Philippines Government is embarking on a program of intensive production of rice and corn, including mechanization of farms to be opened up in the vast areas of virgin lands in many regions of the Philippines. One of the most important problems that has come up is the drying and storage of corn and combined rice. Hitherto neither individuals nor corporations have ever attempted storage of corn and rice on a large scale. We are therefore interested in securing information about the construction of rice drying equipment and grain elevators.

SANTIAGO R. CRUZ

Senior agricultural engineer
Bureau of Plant Industry
Philippines Department of Agriculture and Natural Resources

New Federal and State Bulletins

Farm Buildings Plans. Kentucky Agricultural Extension Circular 397 (revised February, 1948). A catalogue of plans and other farm buildings information which the Kentucky Extension Service has available for distribution.

Floors and Pavements for Homes and Gardens, by H. E. Wichers. Kansas State College Bulletin No. 55 (Manhattan, January, 1948). A comprehensive 67-page bulletin on residential floors and pavements of all kinds.

Farm Pond Building, by John R. Haswell, Charles G. Burress, and C. Howard Bingham. Pennsylvania Agricultural Service Circular 320 (June, 1948). A practical guide for farm planning and construction of ponds.

Electric Heating Cable for a Poultry Water Supply, by C. N. Turner. Cornell Agricultural Extension Bulletin 734 (March, 1948). Practical information on materials, layout, and connections.

THE GROUP ATTENDING THE ASAE NORTH ATLANTIC SECTION MEETING AT GUELPH, CANADA

This is part of the group of 235 men, women, and children — members and friends of the American Society of Agricultural Engineers — making up the attendance at the meeting of the Society's North Atlantic Section held on the campus of the Ontario Agricultural College at Guelph, September 8 to 10. The agricultural engineering staff of O.A.C., ably assisted by their wives and other members of the faculty and administrative staff of the College, served as hosts and made the occasion a most happy one for the visitors. On the closing day of the meeting Massey-Harris Co., Ltd., entertained the group with a complimentary trip, with all the "trimmings", to the Canadian National Exhibition at Toronto. The first row in the picture includes the following officers or ex officers of the Section and the Society: (Reading from left to right) R. C. Proctor, retiring vice-chairman, and H. E. Besley, retiring chairman, North Atlantic Section; A. J. Schwantes, president, ASAE; (reading from right to left) first man not identified, R. G. Harvey, past chairman, and K. H. Gorham, secretary-treasurer, North Atlantic Section; Geo. A. Rietz, past-president, ASAE, and past-chairman, North Atlantic Section. The new officers of the Section for the ensuing year are: Chairman, Ralph J. Bugbee, manager, farm dept., Central Vermont Public Service Corp.; vice-chairman, H. N. Stapleton, head, agricultural engineering dept., University of Massachusetts, and secretary-treasurer, K. H. Gorham (re-elected), business manager, "Electricity-on-the-Farm"

New Jamesway Barn Cleaner

SAVES $1\frac{1}{3}$ HOURS EVERY DAY

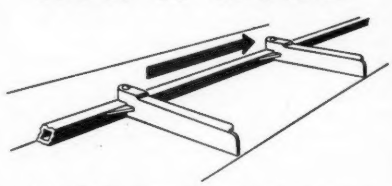
Report Maurice and Howard Smith, Lake Mills, Wis.

It's here! A *new* kind of electric barn cleaner — one that ends the toughest, hardest, most back-breaking chore on the farm. "Before we got our Jamesway barn cleaner," says Howard Smith, "it took us $1\frac{1}{2}$ hours to clean up after 41 cows. Now we do it in 10 minutes."

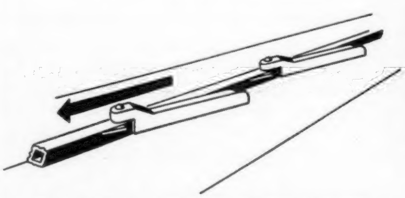
Mr. Smith likes the Jamesway barn cleaner best because of its new, exclusive shuttle action. It uses *no* gutter chains. Makes cross gutters *unnecessary!*

Find out *all* the facts about this new barn cleaner now! See your Jamesway dealer. You'll be surprised how much money you'll save by putting a Jamesway cleaner in *your* barn. For free literature, write James Mfg. Co., Fort Atkinson, Wisconsin, Dept. ....

HOW IT WORKS



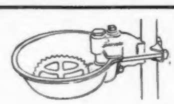
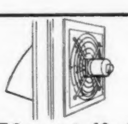
PULL STROKE. Hinged blades attached to square tube pull manure 8 feet at a single stroke. No gutter chains to wear, rust, or break.



PUSH STROKE. Blades fold against tube and slide past manure. This repeated shuttle action quickly cleans the gutter. Power unit and loader are outside the barn.

Here Howard Smith, right, and his father, Maurice, time their Jamesway barn cleaner. This barn is 100 years old — made modern with Jamesway plans and equipment.

✓ Check this Jamesway Chart to see how much time you can save

 ☐ Save up to 40 minutes a day with Jamesway feed truck.	 ☐ Save up to 30 minutes a day with Jamesway water cups.	 ☐ Save up to 10 minutes a day with Jamesway ventilation.	 ☐ Save time and feed with Jamesway "Pork Maker" hog feeders.

YOUR Jamesway DEALER

The World's Largest Manufacturer of Barn and Poultry Equipment

James Mfg. Co.

Ft. Atkinson, Wis.
Elmira, N. Y.
Oakland, Calif.

NEWS SECTION

Toledo Host to Michigan Area Section

THE USDA Engineering Laboratory at Toledo, Ohio, played host to the Michigan Area Section of the American Society of Agricultural Engineers, for its fall meeting, Saturday, October 23. A total of 67 members and guests registered for the meeting. "New Developments and Equipment for Spraying and Dusting Agricultural Crops" was the general subject for the meeting.

For the morning session, Frank Irons, senior agricultural engineer at the Laboratory, divided the visiting group into three parts, which rotated in observing three phases of the work at the Laboratory. Mr. Irons explained and demonstrated special equipment for research on dusts and dusting, including the uniform dust feed mechanism developed at the Laboratory. Orve K. Hedden showed experimental and modified commercial spraying, dusting, wet dusting, and steam dispersal equipment. Dr. C. H. Batchelder, entomologist, presented the spray and dusting material side of the research being handled at the Laboratory, with particular emphasis on the corn borer problem. He showed the need for close cooperation between the scientist and engineer in working out materials satisfactory from a pest control and crop tolerance standpoint and having characteristics favorable to mechanical distribution.

At noon the group moved to the Hillcrest Hotel for luncheon and the balance of the program. M. L. Bailey of Michigan State College, who was in charge of the program, introduced Dan M. Guy, agricultural engineer, Ethyl Corp., and chairman of the Section. As chairman, Mr. Guy introduced several of the guests present, and called on Frank W. Peikert, secretary of the Section, to announce the next meeting of the Section. Mr. Peikert reported that the Section is to meet next on Saturday, February 12, at Michigan State College, East Lansing, for a program featuring the utilization of agricultural resources.

A. W. Farrall, head of the agricultural engineering department at Michigan State College, and chairman of the local arrangements committee for the Annual Meeting of the ASAE at East Lansing next June, pictured for the group the significance to the local area of having the national meeting held in Michigan, and the responsibility involved. He indicated that a plan had been set up under which members of the Section connected with Michigan State College would be responsible for matters on which their connection and knowledge of the local situation would be of particular value. Other members of the Section are to be responsible for other phases of local arrangements utilizing their special abilities and familiarity with the state and immediate surrounding areas.

During the afternoon the Section heard two papers. Dr. Herbert A. Crandell, superintendent, Toledo Area Sanitary District, told how mosquito control work was started and is being carried on in the area. Dr. Harold A. Waters, of the technical division, Sherwin Williams Co., spoke on problems and developments in spraying and dusting materials.

Chicago Section Visits Research Center

WHAT PROVED to be a "Red Letter Day" indeed for the Chicago Section of the American Society of Agricultural Engineers, occurred on October 11 when members and friends of the Section were the guests of the International Harvester Company at its Manufacturing Research Center in Chicago.

Nearly 200 persons attended this interesting and educational event. After assembling early in the afternoon at the Research Center, they were addressed by M. C. Evans, manager of the Center, who explained its purpose and described the scope of the Company's research activities. Following Mr. Evans' talk, nearly three hours were spent in touring the Center where the work of each of the several laboratories was explained as the tour progressed.

Following the tours, dinner was served at the Center with the compliments of the Company.

A short program followed the dinner, which was presided over by W. R. Peterson, chairman of the Chicago Section, and in charge of the Harvester Company's experimental farm at Hinsdale, Illinois. Mr. Peterson first introduced A. E. W. Johnson, director of engineering, of the International Harvester Company, who spoke briefly. The guest speaker of the evening was Dr. W. E. Carroll, associate director of the Illinois Agricultural Experiment Station, who discussed the subject of agricultural research.

A short business meeting of the Chicago Section followed the program, the principal feature of which was the election of new officers for the ensuing year. Those elected include the following: Chairman, D. G. Womeldorf, manager of agricultural sales, Public Service Company of Northern Illinois; vice-chairman, J. H. Wessman, editor, Consumer Relations Department, International Harvester Co., and C. R. Olson, manager, Olson Management Service; secretary-treasurer, H. F. Carroll, manager, farm equipment division, Montgomery Ward & Company.

A.S.A.E. Meetings Calendar

November 12 and 13—PENNSYLVANIA SECTION, Lewiston and State College, Pa.

December 13-15 — WINTER MEETING, Stevens Hotel, Chicago.

January 31 to February 2 — SOUTHEAST SECTION, Louisiana State University, Baton Rouge, La.

February 3 — PACIFIC COAST SECTION, University of California, Davis.

June 20 to 23 — ANNUAL MEETING, Michigan State College, East Lansing, Mich.

Stapleton New A-E Head at U. of M.

EFFECTIVE September 1, Herbert N. Stapleton officially became head of the agricultural engineering department at the University of Massachusetts, Amherst. For the past year, Mr. Stapleton has been serving as acting head of the department.

Georgia Section Holds Fall Meeting

THE GEORGIA Section of the American Society of Agricultural Engineers held its fall meeting in Athens, October 8 and 9. The program was a varied assortment of subjects dealing with the problems and opportunities existing in the various fields of agricultural engineering within the state. The 42 persons attending this meeting were brought up to date on many of the agricultural engineering activities in Georgia. The high light of the meeting was reached in R. H. Driftmier's talk on coordinating all agricultural engineering effort, in which he stressed the responsibility of agricultural engineers for doing more basic research and the need for better coordination of all engineering effort within the profession.

It was decided by those present that the spring meeting of the Section would be a fishing expedition on the Gulf of Mexico, as has been the custom for a number of years.

British Ag Engineers Announce Meetings

FOUR OPEN meetings of the Institution of British Agricultural Engineers for the fall and winter were recently announced.

The first was held October 19, with A. R. Williams of the Rural Industries Bureau discussing the training of agricultural mechanics.

On November 30, P. C. Finn-Kelcey is scheduled to present the application of barn hay drying, with particular reference to the British Isles.

Recent development of agricultural spraying equipment is to be reported by W. E. Ripper when the Institution meets January 18. The program for a meeting March 1 is to be announced later.

All meetings are to be held at the Institution of Electrical Engineers, Savoy Place, London, WC 2, England, beginning at 2:30 p.m.

New Farm Structures Curriculum at Wisconsin

A NEW 5-year curriculum in agricultural engineering specially planned as foundation training for engineering work in the farm structures field, has been announced by the University of Wisconsin.

In a total of 172 semester credits, the curriculum calls for 48 credits in general engineering and mathematics courses, 26 credits in agricultural engineering courses, 24 credits in civil engineering, and 12 credits in mechanical engineering. Other studies in the curriculum are grouped as 22 credits in general courses, 33 credits in general agricultural courses, and 7 elective credits.

The 26 credits in agricultural engineering include courses in surveys and structures, farm mechanics, architectural drawing, home architecture, farm architecture, seminar, and special problems. Three new courses in home architecture have been provided to round out this curriculum. The agricultural engineering courses are scheduled in the second, third, and fourth years of the curriculum.

Personals of A.S.A.E. Members

L. L. Boyd, until recently a research fellow in agricultural engineering at Iowa State College, was recently appointed assistant professor of agricultural engineering at Cornell University, Ithaca, N. Y.

Roy G. Brandt, until recently a consultant with the Lavers Engineering Co., is now employed as design engineer at The Oliver Corp's. plant at South Bend, Indiana.

Gavin C. Bristow, a recent graduate in agricultural engineering of Virginia Polytechnic Institute, is now employed as a junior design engineer with the David Bradley Mfg. Works, Bradley, Ill.

Earle F. Cox, formerly a research engineer for Allis-Chalmers Mfg. Co., recently accepted appointment as research professor of agricultural engineering at the University of Massachusetts, Amherst.

Everett H. Davis recently resigned as irrigation specialist with the Georgia Agricultural Extension Service, to become associated as irrigation engineer with Irrigation Equipment Inc., Eugene, Ore., manufacturers of the Stout Cutler valves, and related items for portable sprinkler irrigation systems. Mr. Davis will be located at 2315 15th St., San Francisco 14, Calif.

Sterling Davis, a 1947 graduate in agricultural engineering of Utah State Agricultural College, is now employed as irrigation engineer in the Division of Irrigation, Soil Conservation Service, U. S. Department of Agriculture, and is located at Boise, Idaho.

Donald L. DuBois, formerly assistant civil engineer, Soil Conservation Service, USDA, stationed at Walla Walla, Wash., is now regional conservation engineer, Indian Service, USDI, with headquarters at Swan Island, Portland, Ore. He will be in charge of soil conservation engineering work on Indian-owned lands in Oregon, Washington, Idaho, California, and Nevada.

Howard H. Engelbrecht, a graduate in agricultural climatology of Iowa State College, is now employed as meteorologist with the U. S. Weather Bureau office at 50 Fulton St., San Francisco.

Angus H. Franklin, formerly veterans agriculture teacher of the Florida State Department of Education, is now agricultural representative of Gibbs Equipment Division, Tallahassee, Fla., distributors of Massey-Harris and Caterpillar products.

W. T. Graham recently resigned as buyer, farm equipment division, Montgomery Ward & Co., to accept a position as farm equipment buyer for Jim Brown Stores, Inc., Cleveland, Ohio.

Wesley W. Gunkel has resigned as instructor in agricultural engineering at Iowa State College, to accept appointment as assistant professor in the agricultural engineering department of Cornell University, Ithaca, N. Y.

Allen M. Hewlett, formerly connected with the Kekaha Sugar Company, Ltd. of Hawaii, is now assistant superintendent of mill engineering for the United Fruit Sugar Co. at Preston, Oriente, Cuba.

George B. Hill, formerly head of the engineering department of the John Deere Ottumwa Works, is now chief engineer of the New Holland Machine Division of The Sperry Corp. at New Holland, Pa.

Paul W. Jenicek, formerly a structural designer for Stone and Webster Engineering Corp., is now employed as a structural draftsman-designer for Jones and Laughlin Supply Co. at Tulsa, Okla.

Earl G. Johnson, formerly a zone conservationist of the USDA Soil Conservation Service, is now an agricultural engineer in the Department of the Army, Natural Resources Section, General Headquarters, Supreme Commander Allied Powers, and is engaged in the reclamation and development of ex-military and other uncultivated lands.

Marion G. Krebs has been promoted from his work in the sales department of the John Deere Plow Co., at Portland, Ore., to assistant sales manager of the John Deere-Lindeman Co., Yakima, Wash.

George L. Kurchinsky, formerly sales engineer, Hertzler and Zook Co., is now employed as engineer by the Eureka Mower Co., Utica, N.Y.

J. Dewey Long, who served last year as consulting agricultural engineer to the Ministry of National Economy of Colombia, and who was previously director of education and market research of the Douglas Fir Plywood Assn., recently accepted appointment as special assistant to A. W. Turner, head of agricultural engineering research (BPISAE), U. S. Department of Agriculture. Mr. Long will participate in development of cooperative studies with other scientific groups on research having engineering implications. An integrated approach to research problems has been fostered in the USDA Agricultural Research Administration, with the different subject matter specialists working as a team to find the answers, and the appointment of Mr. Long will direct additional attention to the engineering phases.

John L. Marsh, formerly an engineer for Wood Brothers Thresher Co., is now supervisor of implement engineering at the Rock Island Works of J. I. Case Co., Rock Island, Ill.

W. McNab Miller, until recently a graduate student in agricultural engineering at the State College of Washington, was recently appointed instructor and research engineer in agricultural engineering at the University of Wyoming, Laramie. *(Continued on page 504)*


MASSEY HARRIS

Personals of A.S.A.E. Members

(Continued from page 502)

Charles L. Martz, a recent graduate in agricultural engineering from Michigan State College, is now employed as an experimental engineer at the Springfield, Ohio works of The Oliver Corp.

O. C. Nordahl of Rilco Laminated Products, Inc., has been named field representative of the company for its territory in western Kansas and Nebraska, eastern Colorado, and southeastern Wyoming. His headquarters will be P. O. Box 535, Manhattan, Kans.

Bernard L. Parsons has been appointed an instructor in the agricultural engineering department at Virginia Polytechnic Institute, Blacksburg.

Joe T. Rogers, a recent graduate in agricultural engineering of the A. & M. College of Texas, recently received appointment as an engineer for the Soil Conservation Service, USDA, and will be located at Rockwell, Tex.

Rodney P. Ryker, formerly supervisor of hydraulics, Washington Department of Conservation and Development, is now district engineer for The Asphalt Institute with headquarters at Seattle.

J. P. Schaenzer, head, electro-agriculture section, technical standards division, Rural Electrification Administration, USDA, is the author of a paper, entitled "Electric Equipment for Poultry Production in the United States", which he prepared especially for presentation at the 8th World's Poultry Congress held at Copenhagen, Denmark, on August 20.

M. A. Sharp, head, agricultural engineering department, University of Tennessee, has been selected by the U. S. Department of Agriculture as head of a six-man mission to determine farm machinery needs in 16 European countries, including the type of farm machinery needed and the amount of farm equipment which can be produced by industry in each country. This will be the second recent European agricultural trip for Mr. Sharp; during the past spring, he was sent to Greece by the USDA to help train Greek teachers in the use of farm machinery. The group will visit countries under the Economic Cooperation Administration. Other members of the ECA team will be two representatives from the USDA, an agricultural economist, and two men from the farm machinery industry.

John P. Spielman is now employed as power use specialist (Region 7), Rural Electrification Administration, and is located at Fountain, Colo.

Stanley C. Swanson recently resigned as engineer for the Gates Rubber Co., to accept a similar position in the V-belt department of Boston Woven Hose & Rubber Co., Cambridge, Mass.

Robert H. Vahrenkamp, formerly a district conservationist of the U. S. Soil Conservation Service, is now director of the soil and water conservation program of the Guadalupe-Blanco River Authority, an agency of the State of Texas with powers and responsibilities to develop and conserve the soil, water, and forest products of the two streams and their watersheds. His program is primarily one of construction in cooperation with six soil conservation districts.

Vernon G. Woods has resigned as junior agricultural engineer engaged in cotton mechanization work at the Mississippi Delta Experiment Station, to accept a position as agricultural engineer in soil conservation work with the Indian Service, U. S. Department of the Interior, on the Shoshone Indian Reservation at Owyhee, Nev.

New Federal and State Bulletins

Modified Short-time Pasteurizer for Farm and Home Use, by E. O. Anderson, W. A. Junnila, and Patricia MacLeod, University of Connecticut. (Reprint from American Milk Review, June, 1948).

Disk Plows and Their Operation, by I. F. Reed. USDA Farmers' Bulletin No. 1992 (May 1948). Comparison with moldboard plows, standard and vertical disk plows, hitches, adjustment and operation, care, draft and penetration.

Farm Freezers, by William H. Knight and J. W. Martin. Idaho Farm Electrification Leaflet No. 3. (July, 1948). A four-page digest on choices as to building or buying, type, size, and cost.

Evaporation from Water Surfaces in California, prepared by Arthur E. Young. California Department of Public Works Bulletin No. 54A (1948). Presents basic data supporting the summary by the same title published in 1947 and previously noted (p. 82, Feb., 1948).

Suggested Plans for Vacation Buildings, by C. A. Gunn. Michigan Agricultural Extension Service, Tourist and Resort Series Folder R-303 (May 1948).

A 9x16-inch sheet, folded to 4x9-inch size, printed on both sides, showing floor plans and elevation views of cabins, cottages, and lodges. Plan numbers suggest that further information is available on each of the several plans outlined.

Engineering and Population Pressures

(Continued from page 475)

In the words of Warren S. Thompson, "Since the middle of the 18th century, the population of Occidental lands has undergone a growth in numbers and a change in distribution which . . . . is unprecedented. These revolutionary changes . . . . are for the most part by-products of scientific knowledge. . . . . Pushed to it, we are endeavoring to develop new means of sustaining human life. . . . . If man continues his unthinking exploitation, it will take more than a research chemist to insure survival."

What these scientists are saying is that, on a finite planet, increases in population and their use of resources cannot correctly or safely be considered as mathematical progressions which will continue to infinity. Neither can it be expected that a level will be reached painlessly and without human effort. It is time to anticipate that human population can reach and temporarily exceed the supporting capacity of the earth. Population will be limited by moral force, or by biological forces such as hunger, war, and pestilence, or by both.

During much of the period since Malthus pictured this problem more than 100 years ago, his theory has been largely discredited. Science, engineering, and industry have increased production of the physical means of living even more rapidly than the population has increased in Occidental lands. The direct result has been an improvement in levels and standards of living.

But this has been accompanied by large-scale exploitation of exhaustible resources. Even assuming the full potential development of substitute resources, synthetic materials, and economic large-scale recovery and reuse of important materials, it is difficult to see how production can keep ahead of population increase for very much longer.

The development and popular acceptance of new concepts of the relative moral and humanitarian merits of alternative quantity or quality living may be a slow process. Meanwhile population will continue to increase. Engineers can anticipate that the increase may complicate their working conditions as well as their subject matter.

With reduced elbow room and freedom of action, engineers will be called upon to further improve utilization and conservation of the forces and materials of nature, for the benefit of more people, over longer life spans. In doing it engineers will be required to deal effectively with the physical aspects of congestion, its transportation bottlenecks, sanitary hazards, and conflicting interests in the use of limited space and resources, to name a few.

Agricultural engineers will be particularly concerned because of their close association with the basic production of food and fiber necessities, with resources which can be conserved and renewed to a greater extent than many other resources, with farm needs for space in which to operate most efficiently, and with the farm source of much of our population increase and best leadership.

New Literature

PROFESSIONAL REGISTRATION LAWS AND THE ENGINEER, by A. M. Sargent. Paper, 60 pages, 5½x8½ inches. Indexed. A. M. Sargent (19699 John R. St., Detroit 3, Mich.). $.75 (lower prices on quantity orders).

Subtitled "An Examination of the History and Facts Behind Professional Registration for Engineers," this purports to be an impartial study of the subject in the interest of the profession. The author is a doctor of engineering and a registered professional engineer with long experience in the machine tool engineering field.

So much has been said for registration of engineers that it may be surprising to some to encounter a viewpoint indicating that existing registration laws have some bad features as well as good ones, and that injustices and iniquities have arisen in the administration of the laws. The author suggests remedies for these adverse conditions.

Various aspects of the subject indicated by subheadings are: How registration began; licensing of other professions; can professional status be attained by legislation?; Illinois court attacks vital points of registration laws; what is engineering and who is an engineer?; who is a professional engineer?; engineers who should not be licensed; exemptions; licensing and collective bargaining; how licensing can affect individual engineers; registration as it affects *(Continued on page 508)*

New Literature *(Continued)*

engineering firms; examination and experience requirements, and administration of registration laws.

The author concludes that the original intent of the laws is sound and valid; that they should be inforced in the interest of the public, on matters in which the public is not free to exercise its own self-interest and judgment; that these instances need to be more precisely defined; that further registration should be permissive rather than mandatory, and that confusion, lack of uniformity, and vagueness of present laws might easily bring dishonor and chaos to the profession.

TENTATIVE FUNCTIONAL REQUIREMENTS FOR CONDITIONING AND STORING FARM CROPS. An 8½x11-inch folder with a table on bulk storage requirements, pressures of stored grain, average outside air conditions in the corn belt for the month following harvest, and optimum requirements for bulk drying. Crops covered are ear corn, shelled corn, wheat, barley, oats, sorghum, soybeans, baled hay, chopped hay, and long hay. Published and made available free by the market development division, Armco Steel Corp. (Middletown, Ohio). The table is based on data obtained from studies under the Armco-Purdue University Fellowship. It supplements an earlier bulletin by the same company, entitled "Storing High Moisture Content Corn and Grain."

CARE AND MAINTENANCE OF FARM TRACTORS, by Alvin H. Hollenberg and Elmer J. Johnson. Paper, v+61 and v+81 pages, 8½x11 inches. Illustrated. Future Farmers of America Foundation, Inc.

Matched instructors' and students' manuals on the subject, covering 12 jobs as follows: Survey of tractor power on the farm and the study of the operator's manual; safe farm tractor operation; servicing spark plugs, generator, starter, magneto, wiring, lights, and batteries; fuel intake and carburetion; servicing the air cleaner; servicing the cooling system; engine lubrication; lubrication of transmissions and final drive; general lubrication of the farm tractor; power application; winterizing the farm tractor, and trouble shooting and recognizing the need for service check-ups. The instructors' manual includes paragraphs on preparation for the teacher, presentation by the teacher, and sample tests under each job heading.

The manuals are being distributed through state supervisors of agricultural education to teachers, students, and others on practically a cost basis, 45 cents for the instructor's manual and 20 cents for the student's manual. C. N. Hinkle, L. H. Ford, and H. G. Kornwolf are ASAE members who assisted in preparation of these manuals.

FARM SOILS (fourth edition), by Edmund L. Worthen. Cloth xiii+510 pages, 5½x8 inches. Illustrated and indexed. John Wiley and Sons (New York 16, N. Y.) $3.20. A text and reference primarily concerned with the how, when, and why of soil management practices. Includes new information developed during the seven years since publication of the third edition. Chapters cover selecting the soil and planning its management, growing the crop, draining and irrigating soils, controlling soil erosion, tilling the soil, manuring, liming, fertilizing, replenishing nitrogen and supplying organic matter, managing field soils, managing pasture soils, managing garden, greenhouse and lawn soils, and managing fruit soils.

SOURCES OF ENGINEERING INFORMATION, by Blanch H. Dalton. Cloth v+109 pages, 6x9 inches, University of California Press (Berkeley and Los Angeles), and Cambridge University Press (London, England). $4.00.

A concise reference guide for engineering students, practicing engineers, research workers, and librarians. Sections cover indexes to periodical and serial literature, abstracts, location of articles and identification of periodicals, bibliography, reference books, trade catalog collection, and standards and specifications.

WISCONSIN HEAVY-DUTY AIR-COOLED ENGINES. Paper, 56 pages, 8½x11 inches. Illustrated. Wisconsin Motor Corp. (Milwaukee 14, Wis.).

This is something more than a catalogue. Amply illustrated on coated paper, it tells the story of the manufacturers products from early history and raw materials to current models and applications, with emphasis on the theme "Engine power multiplies the productive capacity of men, machines and nature." In the largest portion of the book, left-hand pages show various operations in the making of Wisconsin engines, and facing right-hand pages show how they are used in a variety of ways in farm service and in a number of other services. The book is being used to help employees of the company, as well as its distributors, dealers, contract, customers, and prospective buyers, gain a better understanding of the organization, its activities, its products, the uses for its products, and the economic and social significance of mechanical power.

MACHINES FOR THE FARM, RANCH, AND PLANTATION, by Arthur W. Turner and E. J. Johnson. Cloth xvi + 793 pages, 6 x 9 inches. Illustrated and indexed. McGraw-Hill, (New York 18, N.Y.). $6.00.

In this new text and reference each machine is presented on a job activity basis. General classes of equipment covered are seedbed-preparation machines, crop-planting handling machines, mechanical power and transportation machines, general service machines and barn and product equipment. Within each of these groups, information on selecting each specific type of machine included is given, followed by information on operating and field servicing, and on reconditioning and storing. A correlated list of visual aids is included.

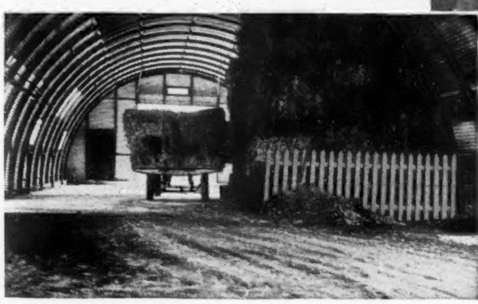
The Farm of Tomorrow

is an

ALL-QUONSET*

Farm

FOUR USES ON ONE FARM—Delbert Hunter, RFD 2, Rochester, Indiana, now has four Quonsets—a Quonset 32 for hay storage; two Quonset 20's, a dairy building and a grain bin; a Quonset 24 for tool and machine shelter.



HAY STORAGE—One of the four Quonsets on the Delbert Hunter farm (see above). This is a Quonset 32 (32 x 96 feet) used for hay storage and for Hunter's spring and fall sales of purebred hogs.

The all-Quonset farm is not merely possible, but probable. Already, Quonsets are serving in virtually every use for which farm buildings are required. They are being erected everywhere, to supplement existing buildings, or to replace obsolete structures and those damaged by storm or fire. Eventually, some farms may have nothing but Quonsets. Or, tomorrow, or next week, where some progressive owner is creating a farm where none existed before, an all-Quonset farm will come into being. Today, whether you are adding a new farm building, or replacing an old one, you can fill your requirements with a Quonset all-steel farm building—permanent, weatherproof, vermin-proof, and fire-resistant. Immediate advantages are their low cost, ready availability, and quick erection. Get in touch with your nearest Quonset dealer today. If you do not know his name, write to the Great Lakes Steel Corporation.

*REGISTERED U. S. PATENT OFFICE

THERE ARE QUONSETS FOR EVERY FARM USE

YOU NAIL TO
STRAN STEEL
FRAMING

GREAT LAKES STEEL CORPORATION

Stran-Steel Division • Dept. 82 • Penobscot Building • Detroit 26, Michigan

UNIT OF NATIONAL STEEL CORPORATION

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Baker, E. D.—Research associate in agricultural engineering, Rutgers University, New Brunswick, N. J.

Blanchard, R. O.—Product designer, Sherman Industries, Inc., 3200 W. Fourteen Mile Rd., Royal Oak, Mich.

Bowden, L. C.—Graduate assistant in agricultural engineering, Alabama Polytechnic Institute, Auburn, Ala.

Breckenridge, Charles M.—Sales engineer, Dickerson Machinery Co., 423 W. First Ave., Spokane, Wash.

Calver, G. L.—Assistant agricultural extension engineer, Provincial Department of Agriculturae, Vancouver, B. C., Canada. (Mail) 1951 Robson St.

Carlson, Clarence J.—Owner, Carlson Engineering Co. and vice-president Tractor Appliance Co. (Mail) R. R. 2, Marshalltown, Iowa.

Carmichael, Carson, Jr.—Agricultural engineer, Appalachian Electric Power Co. (Mail) Clintwood, Va.

Cooley, Dwight R.—Assistant engineer, Papec Machine Co., Shortsville, N. Y.

Forsyth, Warner L., Jr.—Advertising and sales promotion manager, Great Lakes Tractor & Equipment Co., 14401 Ford Rd., Dearborn, Mich.

Gaspar, C. J.—Sales manager, DeBothezat Fans Division, American Machine & Metals, Inc., East Moline, Ill.

Gordon, Allen S.—Agriculture officer, farm machinery, Food and Agriculture Organization of UN. (Mail) 408 Montgomery St., Laurel, Md.

Graeff, Alton W.—Executive vice-president and general manager, Hickman Farm Supplies, Inc., Corner Grand River & DeWitt Rd., Lansing, Mich.

Grafft, Melvin E.—Factory representative, Tractor Div., Allis-Chalmers Mfg. Co. (Mail) Apartado 595, San Jose, Costa Rica, C.A.

Graham, B. I.—Consumer service assistant, Hydro-Electric Power Commission of Ontario, 620 University Ave., Toronto 2, Ont., Canada.

Gujral, Gurnam S.—1107 W. Main St., Urbana, Ill.

Hart, Samuel A.—Research fellow in agricultural engineering, Cornell University, Ithaca, N.Y.

Hedden, Frank H.—Extension agricultural engineer, Georgia Agricultural Extension Service, Athens, Ga.

Hofmeister, H. J., Jr.—Assistant professor of agricultural engineering, University of Maryland, College Park, Md.

Kelly, Robert D.—Assistant drainage supervisor, Kemptville Agricultural School, Kemptville, Ont., Canada.

LaBlanc, Hugh A.—Drainage engineer, Soil Conservation Service, USDA. (Mail) P. O. Box 72, Donaldsonville, La.

Lynch, Paul H.—Farm manager, 1955 5th Ave., S. E., Cedar Rapids, Iowa.

Miller, Gerald M.—Product education manager, Great Lakes Tractor & Equipment Co., 14401 Ford Rd., Dearborn, Mich.

Mortin, A. W.—Service trainee, Harry Ferguson, Inc., 3639 Milwaukee St., Detroit, Mich.

Mueller, Robert C.—Field man, R. M. Wade & Co. (Mail) R. R. 3, Box 848, Milwaukie 2, Ore.

Pandey, Hari Narain—District agricultural engineer, District Agriculture Office, Kanke Rd., P. O. Ranchi, India.

Ronningen, Robert M.—Sales engineer, Ronningen Engineering Sales, Vicksburg, Mich.

Smith, Kenneth O.—Research engineer (BPISAE), U. S. Department of Agriculture. (Mail) General Delivery, Kerman, Calif.

Sutherland, Gail R.—Graduate assistant in agricultural engineering, University of Wisconsin, Madison, Wis.

Whiting, Bruce I.—Chief engineer, Woodmanse Mfg. Co., Freeport, Ill. (Mail) P. O. Box 625.

Winger, Ray J., Jr.—Student in agricultural engineering, University of California, Berkeley, Calif. (Mail) 2945 Russell St.

Wooten, O. B., Jr.—Assistant agricultural engineer (BPISAE) U. S. Department of Agriculture. (Mail) Delta Branch Experiment Station, Stoneville, Miss.

TRANSFER OF GRADE

Lowery, Oscar H.—Extension agricultural engineer, Purdue University, Lafayette, Ind. (Junior Member to Member)

Perkins, B. G.—Manager, industrial research dept., Doane Agricultural Service, Inc., 5144 Delmar Blvd., St. Louis, Mo. (Associate to Member)

New Federal and State Bulletins

The Electrified Farm Shop, by Wm. H. Knight, Idaho Agricultural Extension, Farm Electrification Leaflet No. 1 (Jan. 15, 1948).

Small and large shop floor plans, features, arrangement, equipment, safety ideas, and miscellaneous suggestions.

Milk Cooling on Idaho Farms, by H. L. Brevick, W. H. Knight, and J. C. Boyd, Idaho Agricultural Extension Farm Electrification Leaflet No. 2 (May 15, 1948). Brief general information on the subject.

Farm Freezers, by Wm. H. Knight and J. W. Martin. Idaho Agricultural Extension Farm Electrification Leaflet No. 3 (July 15, 1948). Answers to common farm questions as to whether to build or buy, and on types, sizes, and cost.

Farm Water Measurement, by Max C. Jensen and Mark R. Kulp. Idaho Agricultural Extension Bulletin No. 170 (May 1948).

Instructions on construction, installation, and use of weirs, submerged orifices, and the Parshall measuring flume.

How to Prevent and Control Fire, by C. A. Gunn and Fred W. Roth. Michigan Agricultural Extension Service, Tourist and Resort Series Folder R-301 (June 1947). Brief information on prevention of fires from common causes, and on fire-extinguishing equipment.

Durability of Concretes and Mortars in Acid Soils, with Particular Reference to Drain Tile, by Dalton G. Miller and Philip W. Manson, Minnesota Agricultural Experiment Station Technical Bulletin 180 (June 1948).

This reports methods, results, and conclusions of a study begun in 1923. The duration and extent of the study, as well as the care with which it was conducted, give it a significant place in the technology of concrete, and as an example of sustained research.

Galvanized Roofing for Farm Buildings, by B. F. Muirheid. Illinois Agricultural Extension Service Circular 624. Selection, application, maintenance, and lightning protection.

Mechanized Production of Cotton in Texas, by H. P. Smith and D. L. Jones. Texas Agricultural Experiment Station Bulletin 704.

Covers the subject from disposal of previous crop residue through culture, pest control, and defoliation, to strippers and pickers.

West Virginia University Establishes Professional Agricultural Engineering Curriculum

A FOUR-YEAR curriculum leading to the degree of bachelor of science in agricultural engineering was recently announced by West Virginia University.

It is planned that candidates for this degree will normally register in the college of engineering for their first three years and transfer to the college of agriculture for their last year. Some students may be registered in the college of agriculture pending completion of requirements for enrollment in the college of engineering. Students already started in agriculture, or who may in the future originally enroll in agriculture, may be permitted to transfer to engineering whenever they are able to satisfy the entrance requirements of the college of engineering.

Before graduation, each candidate for this degree will have to meet the farm practice requirement of the college of agriculture and be approved for graduation by the faculties of both colleges.

Members of the agricultural engineering staff teaching the courses in the professional curriculum will be members of the faculties of both colleges.

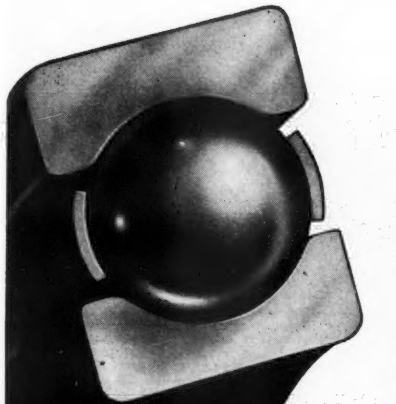
The curriculum provides for 154 semester hour credits, with 98 in mathematics, physics, chemistry, and basic engineering subjects, 15 in agricultural engineering during the senior year, 18 in agricultural sciences, and 23 in English, public speaking, business subjects, military science, and physical education.

Future changes in the curriculum will require approval of the faculties of both colleges. The head of the agricultural engineering department or others designated by him will serve as faculty advisors to agricultural engineering students.

Engineered FOR FARM PROFITS

OLIVER BEGINS ITS SECOND CENTURY WITH A NEW FLEET OF SKF-EQUIPPED TRACTORS

It is significant that SKF Bearings are used on governor, transmission, bevel pinion, power take-off shafts, etc., of Oliver's new tractors. It's the logical step resulting from the close, pleasant and highly satisfactory association between The Oliver Corporation and SKF that has existed for many years.




The SKF Single Row, Deep Groove Ball Bearing will sustain, in addition to radial load, a substantial thrust load in either direction . . . even at very high speeds. This advantage results from the intimate contact existing between the balls and the deep, continuous groove in each ring. This bearing is also available with seals, which serve to exclude dirt and retain lubricant. 6497

SKF INDUSTRIES, INC.
PHILADELPHIA 32, PA.

Personnel Service Bulletin

The American Society of Agricultural Engineers conducts a Personnel Service at its headquarters office in St. Joseph, Michigan, as a clearing house (not a placement bureau) for putting agricultural engineers seeking employment or change of employment in touch with possible employers of their services, and vice versa. The service is rendered without charge, and information on how to use it will be furnished by the Society. The Society does not investigate or guarantee the representations made by parties listed. This bulletin contains the active listing of "Positions Open" and "Positions Wanted" on file at the Society's office, and information on each in the form of separate mimeographed sheets, may be had on request. "Agricultural Engineer" as used in these listings, is not intended to imply any specific level of proficiency, or registration, or license as a professional engineer.

NOTE: In this Bulletin the following listings still current and previously reported are not repeated in detail. For further information see the issue of AGRICULTURAL ENGINEERING indicated.

POSITIONS OPEN: 1947 APRIL—O-552. 1948 JANUARY—O-605, 606. APRIL—O-612, 613, 615. MAY—O-617. JUNE—O-620, JULY—O-624, 626, 627, 629, 630. AUGUST—O-633, 634, 635, 636. SEPTEMBER—O-639, 640, 641, 642. OCTOBER—O-643, 645, 646, 647, 648.

POSITIONS WANTED: 1948 JANUARY—W-137. MARCH—W-146. APRIL—W-158. MAY—W-169. JUNE—W-179. AUGUST—W-184, 189. SEPTEMBER—W-191, 192. OCTOBER—W-193, 194.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEERS (several) for variety of openings in the engineering department of a manufacturing organization expanding its implement engineering work. Current openings for experienced project, field test, cost, design, and junior engineers. Midwest location. BS deg in agricultural engineering or equivalent, and experience as needed for position desired. Excellent opportunity for advancement. These openings are in addition to those being filled by promotion of qualified men within the organization. Good facilities, congenial organization, and management which appreciates the importance of good engineering. Salary open. Top salaries paid for the ability, experience and other qualifications desired. O-615

DESIGN ENGINEER to head planter and cultivator division in engineering department of established full-line manufacturer in Midwest. BS deg in agricultural or mechanical engineering desirable but not absolutely necessary. Must have considerable experience in actually designing cultivators, planters, middlebusters and tractor-mounted implements. Steady position. Age and salary open. O-630

EXTENSION IRRIGATION SPECIALIST to develop sound irrigation program in a northwestern state. MS deg in agricultural engineering, or equivalent, preferred. Previous experience in extension and practical irrigation desirable. Usual personal qualifications for extension work. Opportunity to initiate work, as this is a new position. Salary \$5,000. O-649

DESIGN ENGINEERS (several), for development work on tillage, planting, and cultivating implements, with full-line manufacturer. Midwest location. BS deg in agricultural or mechanical engineering. Experience considered in position and responsibilities assigned. Farm background preferred. Usual qualifications for commercial design. Salary open. O-650

ELECTRICAL DEVELOPMENT REPRESENTATIVE (4 openings) to assist manager of rural electric cooperative in public relations, furnishing technical information on uses of electricity, and carrying on educational programs. Location, Tennessee. BS deg in agricultural engineering, or equivalent. Farm background, good knowledge of electrical applications and farm shop, and some teaching experience desirable. Must be aggressive, have no major physical handicaps, and enjoy working with farmers, dealers, distributors, and educational personnel. Opportunity to prepare for management work. Salary \$225-250 per month for 6-mo probationary period. Future increases according to progress. O-651

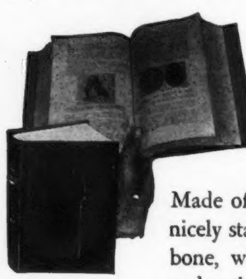
AGRICULTURAL ENGINEERING sales representatives (several), to sell propeller fans to farm implement dealers or direct to customer. Open territories in Midwest, East, and Southeast. Prefer individual or organization with engineering or agricultural background, already selling farm trade. Good character and habits required. Exclusive sales contract granted. Opportunity up to individual. Salary, straight commission. O-652

SALESMAN for agricultural chemicals, to represent chemical division of a large rubber company in territory including Iowa, Missouri, Nebraska, Illinois, Wisconsin, Minnesota, and the Dakotas. Prefer man reared in the area indicated. Usual personal qualifications for effective sales work in agricultural field. Work will include holding sales meetings with farm group dealers, county agents, and salesmen of jobber and distributor units. Opportunity largely up to individual. Salary \$4800 (approx), plus commission and expense account. O-653

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER desires development work in soil and water field. BS deg in agricultural engineering expected January 1949, A and M College of Texas. Dry land and irrigation farming background. College training in irrigation, drainage, hydraulics, soils, and soil conservation. War service 2½ yr, enlisted and non-commissioned, U S Air Force. Hold reserve commission. No disability. Available Jan. 31, 1949. Single. Age 23. Salary open. W-195

AGRICULTURAL ENGINEER desires work in electrification field as professor of electrical or agricultural engineering, research engineer and physicist, design engineer, power system manager, or in industrial organization. MS deg in agricultural engineering, 1934; professional degree of agricultural engineer 1939, Washington State College. Advanced study toward Ph D deg, Iowa State College. Varied teaching, research, extension, and engineering practice, 15 yr. War service engineering work in civilian status with USDI, Maritime Commission, Army Specialized Training Program, US Navy, and War Food Administration. No disability. Available on short notice. Married. Age 38. Salary open. W-196 *(Continued on page 516)*



PROFESSIONAL DIRECTORY

OLSON MANAGEMENT SERVICE

Drainage and Erosion Control Engineering, Structure Design, Farm Architectural Service, Work Simplification Studies, Product Application Engineering, Management, Soil Surveys, and Testing.

904 W. Stephenson St., Freeport, Ill. Tel. State 2601

FRANK J. ZINK ASSOCIATES

Agricultural Engineers

Consultants on product development, designs, research, market research, public relations

FELLOW A.S.A.E.
MEMBER S.A.E.
Suite 4300, Board of Trade Bldg.
Telephone: Harrison 0723 Chicago 4, Illinois

RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

PERSONNEL SERVICE BULLETIN

(Continued from page 514)

AGRICULTURAL ENGINEER desires any combination of development, research, or teaching work in soil and water field, in public service or private employment. BS deg in agricultural engineering, 1944, University of Nebraska. MS deg in agricultural engineering expected, 1949, Michigan State College. Soils inspector and instrument man, Nebraska State Highway Dep't, 3 mo. Graduate assistant, Michigan State College, 1 yr. Instructor, Michigan State College, since September 1948, on research in supplemental irrigation and machinery. Enlisted and commissioned war service, 3½ yr, including 22 mo overseas. No disability. Available April 1949. Single. Age 26. Salary open. W-197

AGRICULTURAL ENGINEER desires sales or development work in rural electric or farm structures field. BS deg in agriculture and in agricultural engineering expected December 1948, Ohio State University. Farm background. Clerk and assistant manager of grocery store 3 yr. Trouble shooter, Columbus and Southern Electric Co., 4 mo. Engineering laboratory, Ranco Inc., 18 mo part time. War non-commissioned service, 33 mo, U S Signal Corps. No disability. Available Jan. 1, 1949. Married. Age 29. Salary $3600. W-198

AGRICULTURAL ENGINEER desires design and research in power and machinery field, in private industry or public service. Self educated. Has designed and constructed flax mill. Developed and designed two-point linkage, close-mounted tractor plow. Designed tractor trailer to minimize wheel slip. Other designs in progress. Experience as flax miller and tillage contractor. Available March 1949. Married. Age 29. Salary open. W-199

AGRICULTURAL ENGINEER desires extension, sales, or service work in soil and water, farm structures, or farm product processing field. BS deg expected December, Iowa State College. Farm background. Experience as veterans' on-the-job farm training supervisor. War non-commissioned service as radio operator and gunner, U S Air Force. No disability. Available January 10, 1949. Married. Age 27. Salary $3000-3300. W-200

AGRICULTURAL ENGINEER desires sales, service, teaching, or research work in power and machinery or soil and water field. BS deg in agricultural engineering expected December 1948, North Carolina State College. Experience in traffic work, 4 yr, sales, 2 yr, war enlisted and commissioned service in Coast Artillery, Anti-Aircraft. Hold reserve commission. No disability. Available January 1, 1949. Married. Age 30. Salary open. W-201

AGRICULTURAL ENGINEER desires development, research, teaching, sales, or service work in rural electric or power and machinery field. BS deg in electrical engineering, 1944, and in agricultural engineering 1947, University of Tennessee. MS deg in agricultural engineering expected March 1949, Michigan State College. Farm background. Engineering trainee, Consolidated Aircraft Co., 1 yr; electrical layout and water plant design, Oak Ridge, Tenn., 4 mo; assistant project engineer, Fulton Sylphon Co., Knoxville, Tenn., development of fibrograph, 5 mo; graduate fellow in research, with some teaching, Michigan State College, 1 yr. War commissioned service in Navy 23 mo, in electrical maintenance department, Bureau of Ships. No disability. Available April 1949. Married. Age 27. Salary open. W-202

AGRICULTURAL ENGINEER desires power and machinery sales and service or soil and water conservation work with private industry. BS deg in agricultural engineering, 1947, Oklahoma A & M College. Survey experience with U S Corps of Engineers, 6 mo; student instructor, soil and water conservation, 1 yr; full time instructor teaching soil and water conservation in land grant college, 6 mo; veterans agricultural instructor, 9 mo. War commissioned service in Corps of Engineers, 4½ yr with promotions to Lieutenant Colonel. No disability. Available on reasonable notice. Married. Age 31. Salary open. W-203

AGRICULTURAL ENGINEER desires employment in any phase of the work except teaching. BS deg in agricultural engineering expected January 1949, Mississippi State College. Experience as investigator, Mississippi State Board of Health, 2 yrs. No disability. Available Feb. 1, 1949. Married. Age 25. Salary open. W-204